
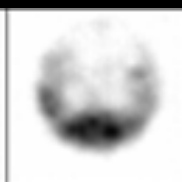
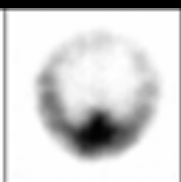



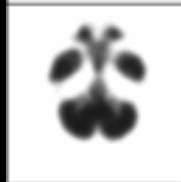
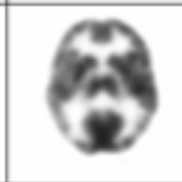
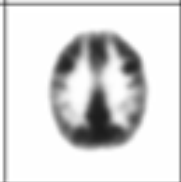
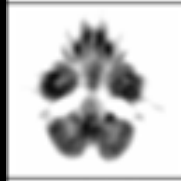
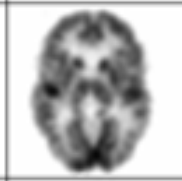




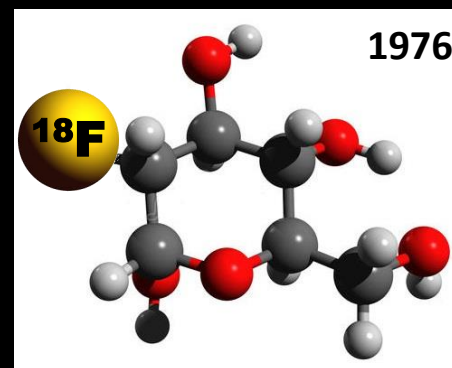
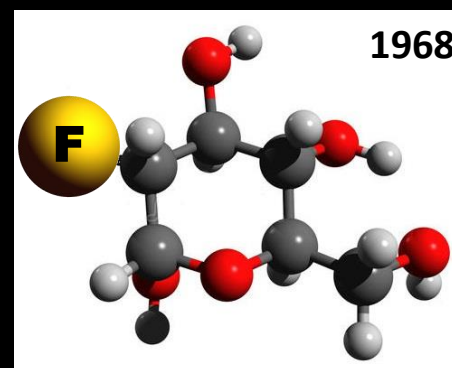

















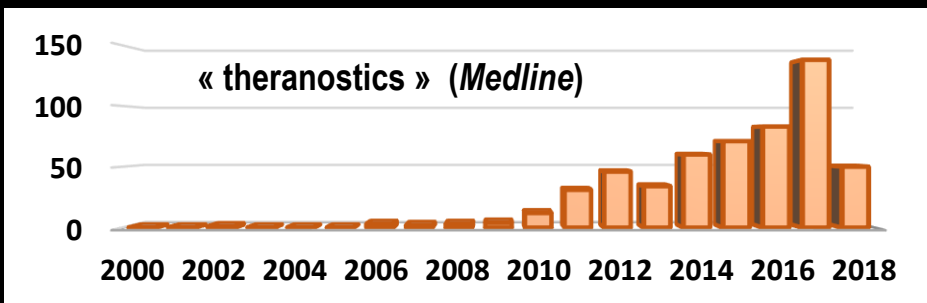
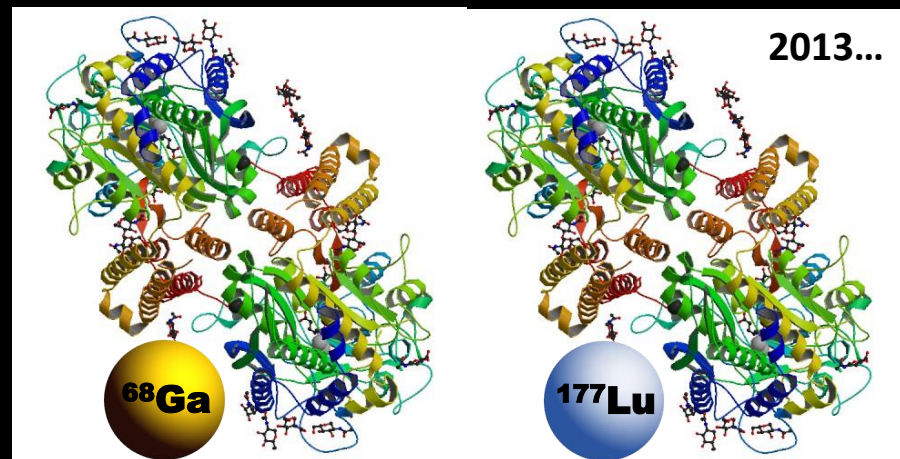
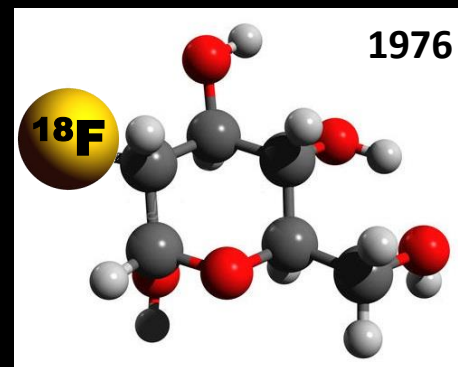
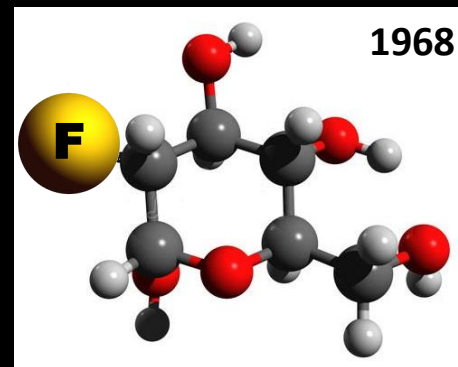
Imagerie métabolique : une histoire récente

			PET III 1975
			ECAT II 1977
			NeuroECAT 1978
			ECAT 931 1985
			ECAT EXACT HR ⁺ 1995



Imagerie métabolique : une histoire récente

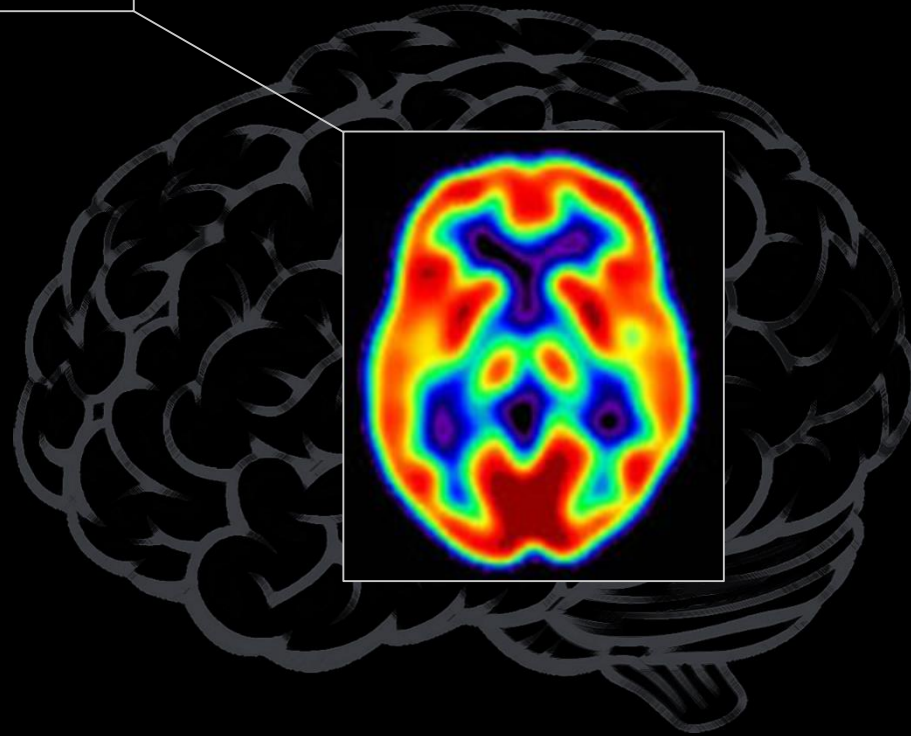
			PET III 1975
			ECAT II 1977
			NeuroECAT 1978
			ECAT 931 1985
			ECAT EXACT HR+ 1995



Voies métaboliques

Métabolisme glucidique

[¹⁸F]-FDG (fluoro-déoxy-glucose)



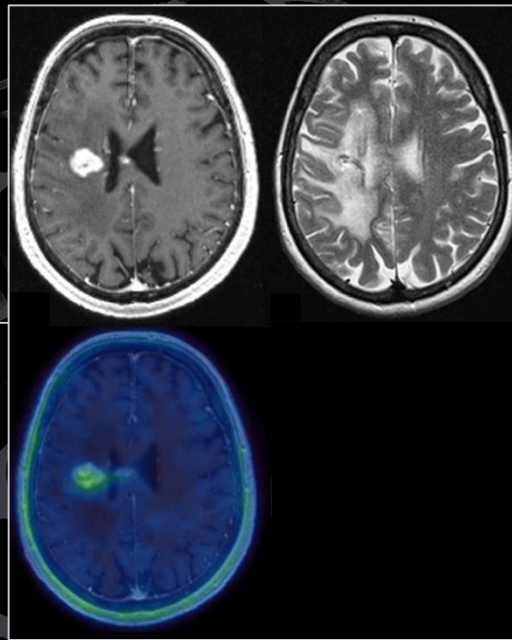
Voies métaboliques

Métabolisme glucidique

$[^{18}\text{F}]$ -FDG (*fluoro-déoxy-glucose*)

Synthèse ADN

$[^{18}\text{F}]$ -FLT (*fluoro-thymidine*)



Voies métaboliques

Métabolisme glucidique

$[^{18}\text{F}]$ -FDG (*fluoro-déoxy-glucose*)

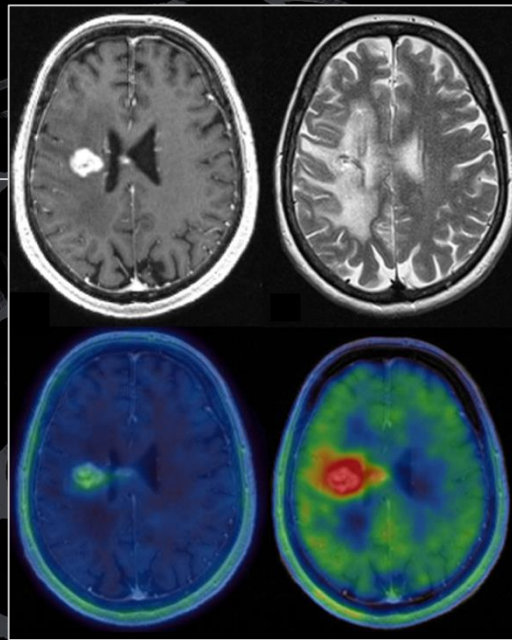
Synthèse protéique

$[^{18}\text{F}]$ -FET (*fluoro-éthyl-tyrosine*)

$[^{11}\text{C}]$ -MET (*méthionine*)

Synthèse ADN

$[^{18}\text{F}]$ -FLT (*fluoro-thymidine*)



Voies métaboliques

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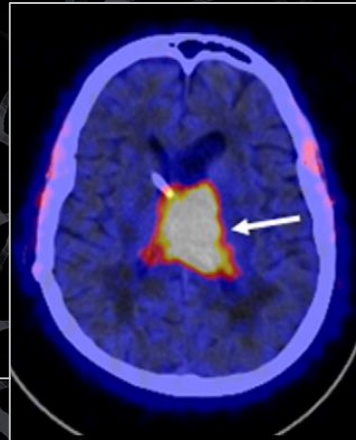
$[^{11}\text{C}]$ -MET (*méthionine*)

Synthèse ADN

$[^{18}\text{F}]$ -FLT (*fluoro-thymidine*)

Synthèse membranaire

$[^{18}\text{F}]$ - ou $[^{11}\text{C}]$ -choline



Voies métaboliques

Hypoxie cellulaire

$[^{18}\text{F}]$ -MISO (fluoro-misonidazole)

Métabolisme glucidique

$[^{18}\text{F}]$ -FDG (fluoro-déoxy-glucose)

Synthèse protéique

$[^{18}\text{F}]$ -FET (fluoro-éthyl-tyrosine)

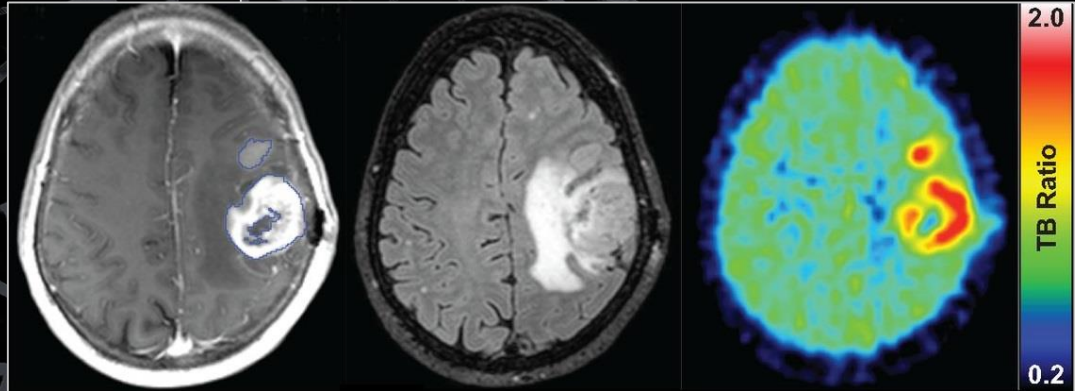
$[^{11}\text{C}]$ -MET (méthionine)

Synthèse ADN

$[^{18}\text{F}]$ -FLT (fluoro-thymidine)

Synthèse membranaire

$[^{18}\text{F}]$ - ou $[^{11}\text{C}]$ -choline



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$[^{11}\text{C}]$ -MET (*méthionine*)

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$[^{18}\text{F}]$ -FLT (*fluoro-thymidine*)

Synthèse membranaire

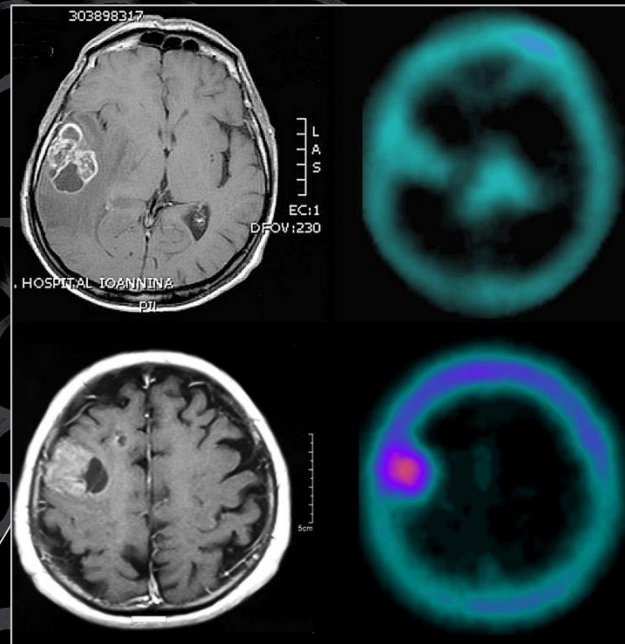
$[^{18}\text{F}]$ - ou $[^{11}\text{C}]$ -choline

Lésion de la barrière hémato-encéphalique

^{201}Tl

$[^{99\text{m}}\text{Tc}]$ -sestamibi / tetrofosmine

Chélates de gadolinium



Voies métaboliques

Métabolisme glucidique

$[^{18}\text{F}]$ -FDG (*fluoro-déoxy-glucose*)

Synthèse protéique

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Synthèse membranaire

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Lésion de la barrière hémato-encéphalique

^{201}Tl

$[^{99\text{m}}\text{Tc}]$ -sestamibi

Chélates de gadolinium

Hypoxie cellulaire

$[^{18}\text{F}]$ -MISO (*fluoro-misonidazole*)

Perfusion

Traceurs lipophiles : $[^{99\text{m}}\text{Tc}]$ -ECD
 $[^{99\text{m}}\text{Tc}]$ -HMPAO

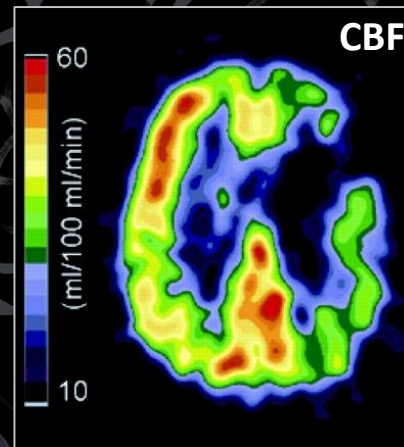
Traceurs diffusibles : $[^{15}\text{O}]$ -H₂O

$[^{15}\text{O}]$ -O₂

$[^{11}\text{C}]$ -CO

$[^{11}\text{C}]$ -CO₂

$[^{13}\text{N}]$ -NH₃



Voies métaboliques

Métabolisme glucidique

$[^{18}\text{F}]$ -FDG (*fluoro-déoxy-glucose*)

Synthèse protéique

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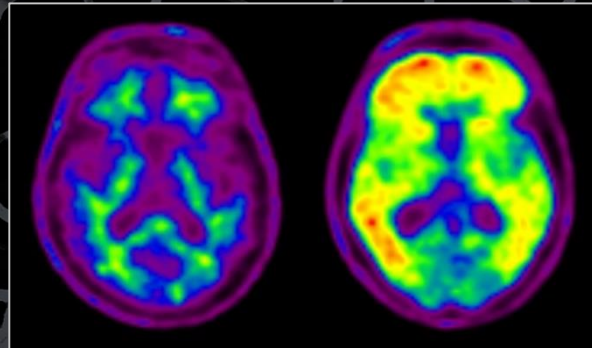
Traceurs diffusibles : $[^{15}\text{O}]$ -H₂O

$[^{15}\text{O}]$ -O₂

$[^{11}\text{C}]$ -CO

$[^{11}\text{C}]$ -CO₂

$[^{13}\text{N}]$ -NH₃



Plaque amyloïde

$[^{11}\text{C}]$ -PIB (*Pittsburgh compound B*)

$[^{18}\text{F}]$ -florbetapir...

Voies métaboliques

Métabolisme glucidique

$[^{18}\text{F}]$ -FDG (fluoro-déoxy-glucose)

Synthèse protéique

$[^{18}\text{F}]$ -FET (fluoro-éthyl-tyrosine)

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$[^{18}\text{F}]$ - ou $[^{11}\text{C}]$ -choline

Lésion de la barrière hémato-encéphalique

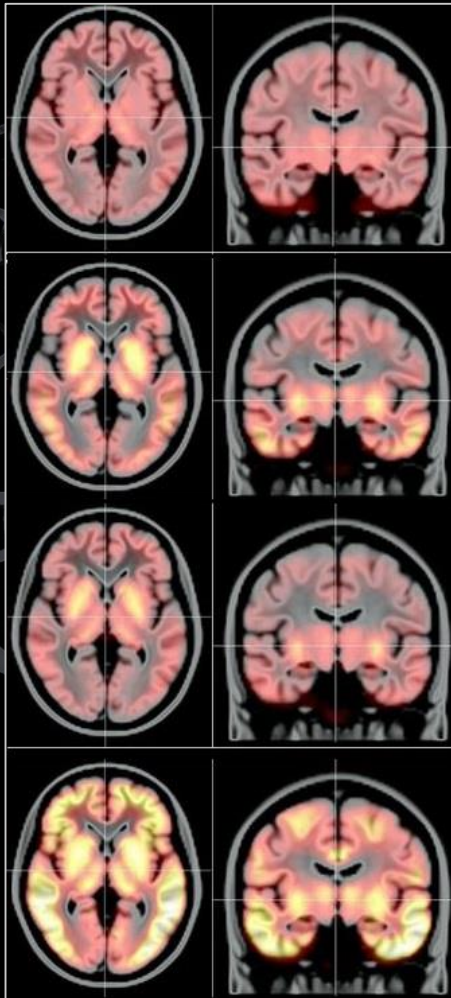
^{201}Tl

$[^{99\text{m}}\text{Tc}]$ -sestamibi

Chélates de gadolinium

Hypoxie cellulaire

$[^{18}\text{F}]$ -MISO (fluoro-misonidazole)



Perfusion

Traceurs lipophiles : $[^{99\text{m}}\text{Tc}]$ -ECD
 $[^{99\text{m}}\text{Tc}]$ -HMPAO

Traceurs diffusibles : $[^{15}\text{O}]$ -H₂O
 $[^{15}\text{O}]$ -O₂
 $[^{11}\text{C}]$ -CO
 $[^{11}\text{C}]$ -CO₂
 $[^{13}\text{N}]$ -NH₃

Plaque amyloïde

$[^{11}\text{C}]$ -PIB (Pittsburgh compound B)

$[^{18}\text{F}]$ -florbetapir...

Tauopathie

$[^{18}\text{F}]$ -AV145

Voies métaboliques

Métabolisme glucidique

$[^{18}\text{F}]$ -FDG (*fluoro-déoxy-glucose*)

Synthèse protéique

$[^{18}\text{F}]$ -FET (*fluoro-éthyl-tyrosine*)

$[^{11}\text{C}]$ -MET (*méthionine*)

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Synthèse membranaire

$[^{18}\text{F}]$ - ou $[^{11}\text{C}]$ -choline

Lésion de la barrière hémato-encéphalique

^{201}Tl

$[^{99\text{m}}\text{Tc}]$ -sestamibi

Chélates de gadolinium

Hypoxie cellulaire

$[^{18}\text{F}]$ -MISO (*fluoro-misonidazole*)

Perfusion

Traceurs lipophiles : $[^{99\text{m}}\text{Tc}]$ -ECD
 $[^{99\text{m}}\text{Tc}]$ -HMPAO

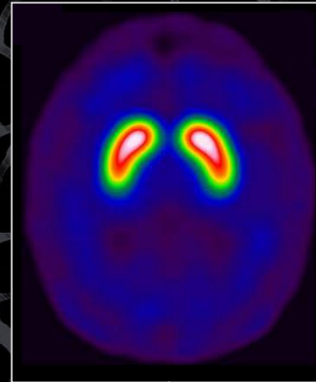
Traceurs diffusibles : $[^{15}\text{O}]$ -H₂O

$[^{15}\text{O}]$ -O₂

$[^{11}\text{C}]$ -CO

$[^{11}\text{C}]$ -CO₂

$[^{13}\text{N}]$ -NH₃



Plaque amyloïde

$[^{11}\text{C}]$ -PIB (*Pittsburgh compound B*)

$[^{18}\text{F}]$ -florbetapir...

Tauopathie

$[^{18}\text{F}]$ -AV145

Récepteurs membranaires

- Dopamine : $[^{123}\text{I}]$ -DaTscan, $[^{18}\text{F}]$ -Dopa, $[^{11}\text{C}]$ -raclopride

Voies métaboliques

Métabolisme glucidique

$[^{18}\text{F}]$ -FDG (fluoro-déoxy-glucose)

Synthèse protéique

$[^{18}\text{F}]$ -FET (fluoro-éthyl-tyrosine)

$[^{11}\text{C}]$ -MET (méthionine)

Synthèse ADN

$[^{18}\text{F}]$ -FLT (fluoro-thymidine)

Synthèse membranaire

$[^{18}\text{F}]$ - ou $[^{11}\text{C}]$ -choline

Lésion de la barrière hémato-encéphalique

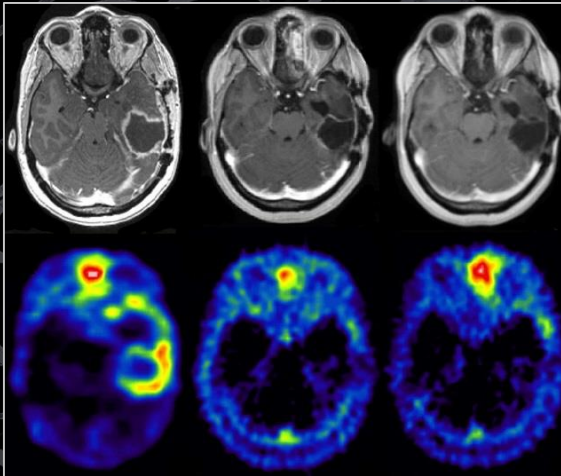
^{201}Tl

$[^{99\text{m}}\text{Tc}]$ -sestamibi

Chélates de gadolinium

Hypoxie cellulaire

$[^{18}\text{F}]$ -MISO (fluoro-misonidazole)



Perfusion

Traceurs lipophiles : $[^{99\text{m}}\text{Tc}]$ -ECD
 $[^{99\text{m}}\text{Tc}]$ -HMPAO

Traceurs diffusibles : $[^{15}\text{O}]$ -H₂O
 $[^{15}\text{O}]$ -O₂
 $[^{11}\text{C}]$ -CO
 $[^{11}\text{C}]$ -CO₂
 $[^{13}\text{N}]$ -NH₃

Plaque amyloïde

$[^{11}\text{C}]$ -PIB (Pittsburgh compound B)

$[^{18}\text{F}]$ -florbetapir...

Tauopathie

$[^{18}\text{F}]$ -AV145

Récepteurs membranaires

- Dopamine : $[^{123}\text{I}]$ -DaTscan, $[^{18}\text{F}]$ -Dopa, $[^{11}\text{C}]$ -raclopride
- Somatostatine : $[^{68}\text{Ga}]$ -DOTA peptides
- Benzodiazépines : $[^{11}\text{C}]$ -flumazenil, $[^{123}\text{I}]$ -iomazenil

Voies métaboliques

Métabolisme glucidique

$[^{18}\text{F}]$ -FDG (fluoro-déoxy-glucose)

Synthèse protéique

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$[^{11}\text{C}]$ -MET (méthionine)

Synthèse ADN

$[^{18}\text{F}]$ -FLT (fluoro-thymidine)

Synthèse membranaire

$[^{18}\text{F}]$ - ou $[^{11}\text{C}]$ -choline

Lésion de la barrière hémato-encéphalique

^{201}Tl

$[^{99\text{m}}\text{Tc}]$ -sestamibi

Chélates de gadolinium

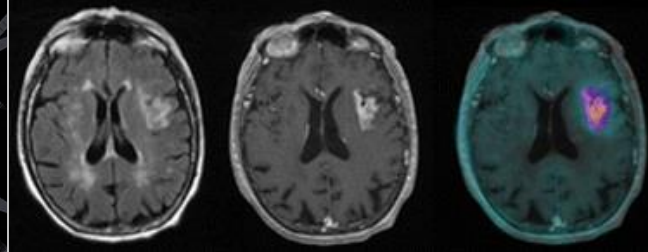
Hypoxie cellulaire

$[^{18}\text{F}]$ -MISO (fluoro-misonidazole)

Neuro-inflammation

Activation microgliale

$[^{18}\text{F}]$ -DPA714



Perfusion

Traceurs lipophiles : $[^{99\text{m}}\text{Tc}]$ -ECD
 $[^{99\text{m}}\text{Tc}]$ -HMPAO

Traceurs diffusibles : $[^{15}\text{O}]$ -H₂O

$[^{15}\text{O}]$ -O₂

$[^{11}\text{C}]$ -CO

$[^{11}\text{C}]$ -CO₂

$[^{13}\text{N}]$ -NH₃

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$[^{11}\text{C}]$ -PIB (Pittsburgh compound B)

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Tauopathie

$[^{18}\text{F}]$ -AV145

Récepteurs membranaires

- Dopamine : $[^{123}\text{I}]$ -DaTscan, $[^{18}\text{F}]$ -Dopa, $[^{11}\text{C}]$ -raclopride

- Somatostatine : $[^{68}\text{Ga}]$ -DOTA peptides

- Benzodiazépines : $[^{11}\text{C}]$ -flumazenil, $[^{123}\text{I}]$ -iomazenil

Métabolisme glucidique : ^{18}F FDG

Cerveau :

- 2% du poids du corps
- 15% du débit sanguin : $\text{CBF} \sim 55 \text{ mL}/100\text{g}/\text{min}$
- 20% de la consommation d' O_2 : $\text{CMR}_{\text{O}_2} \sim 3.5 \text{ mL}/100\text{g}/\text{min}$
- 20-25% de la consommation de glucose : $\text{CMR}_{\text{glu}} \sim 6 \text{ mg}/100\text{g}/\text{min}$

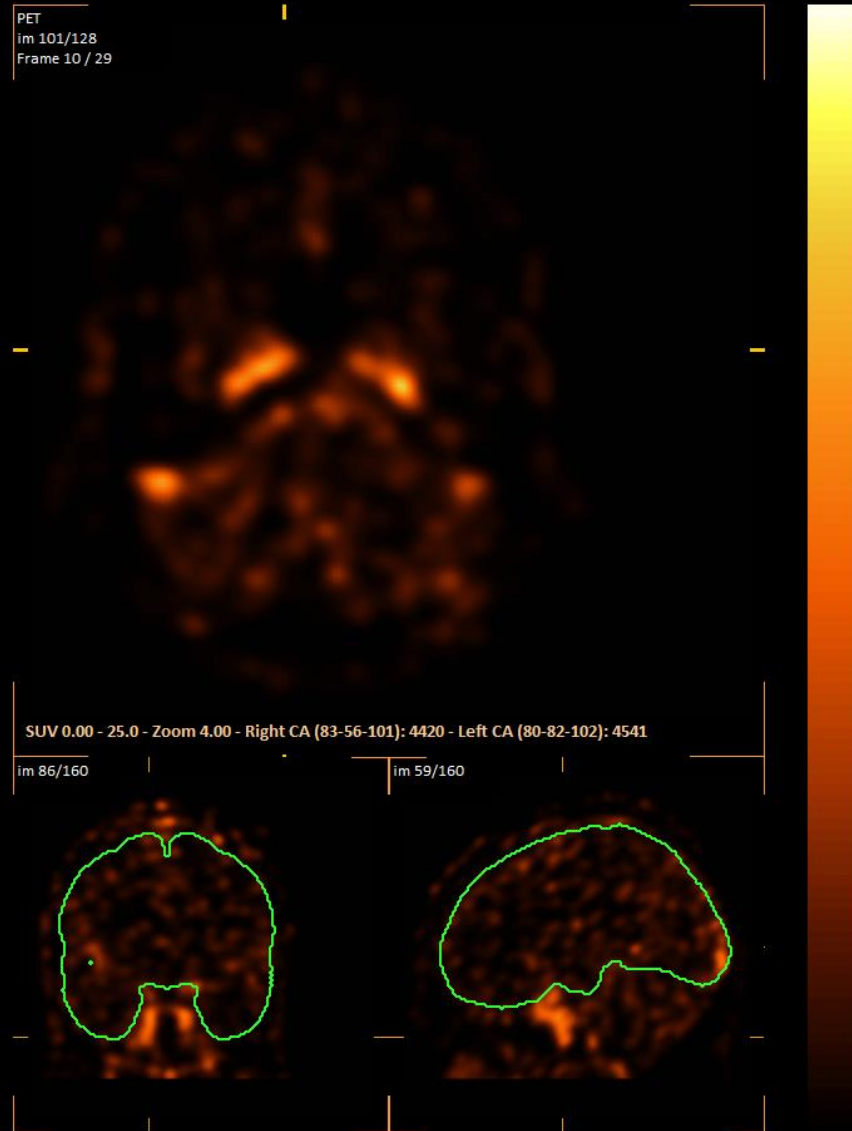
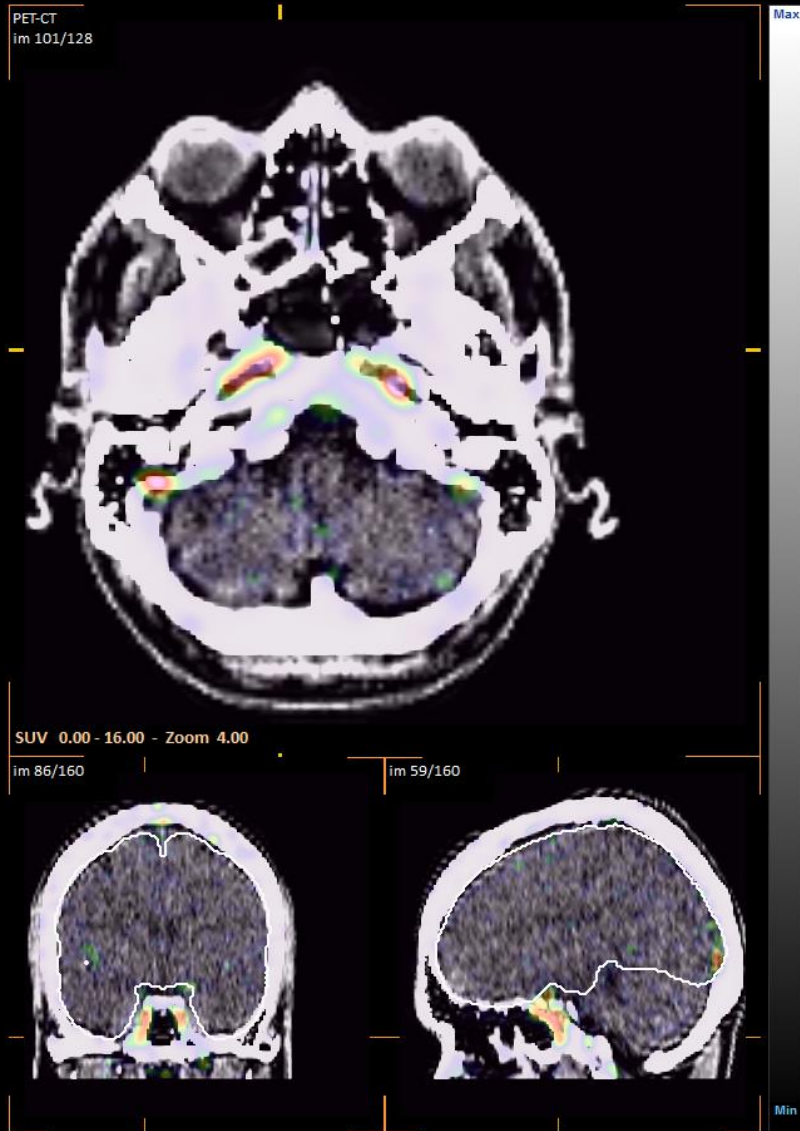
A l'équilibre, $[\text{Glu}]_{\text{tissue}} \sim 20\% [\text{Glu}]_{\text{plasma}}$

Forte corrélation $\text{CMR}_{\text{glu}} / \text{CBF}$



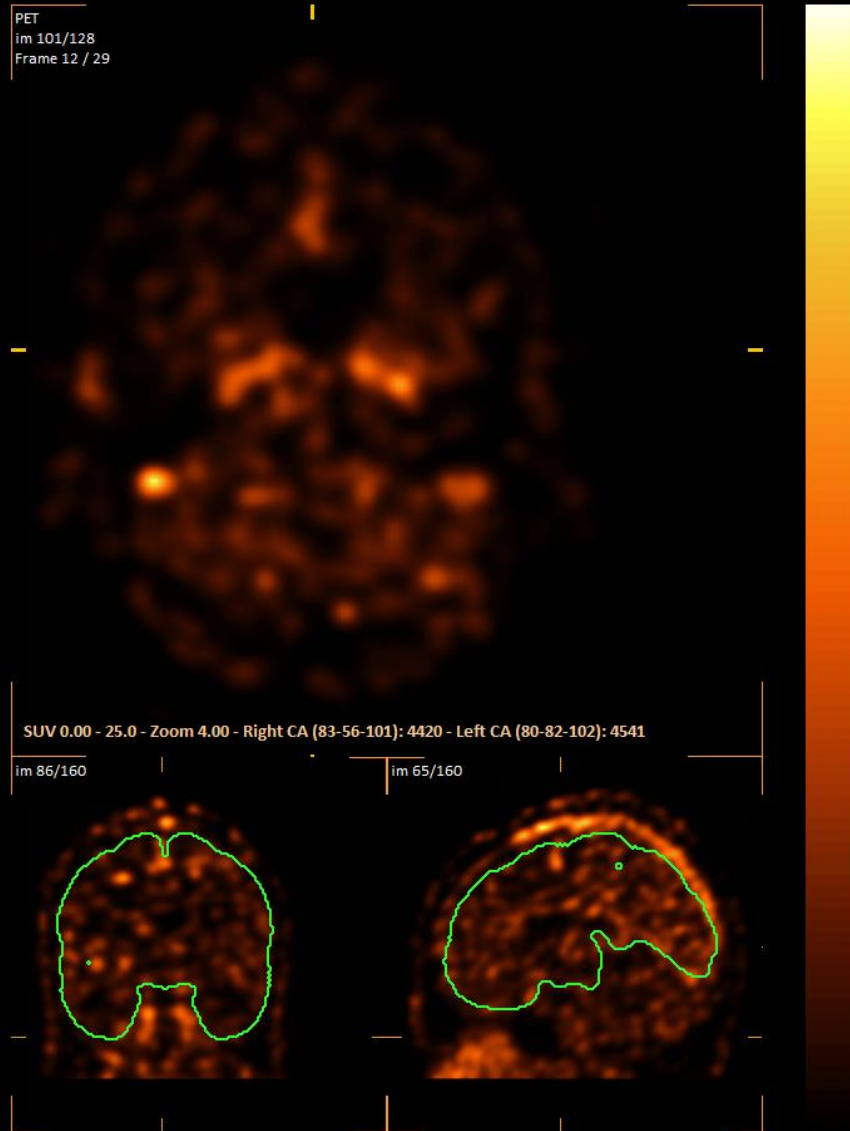
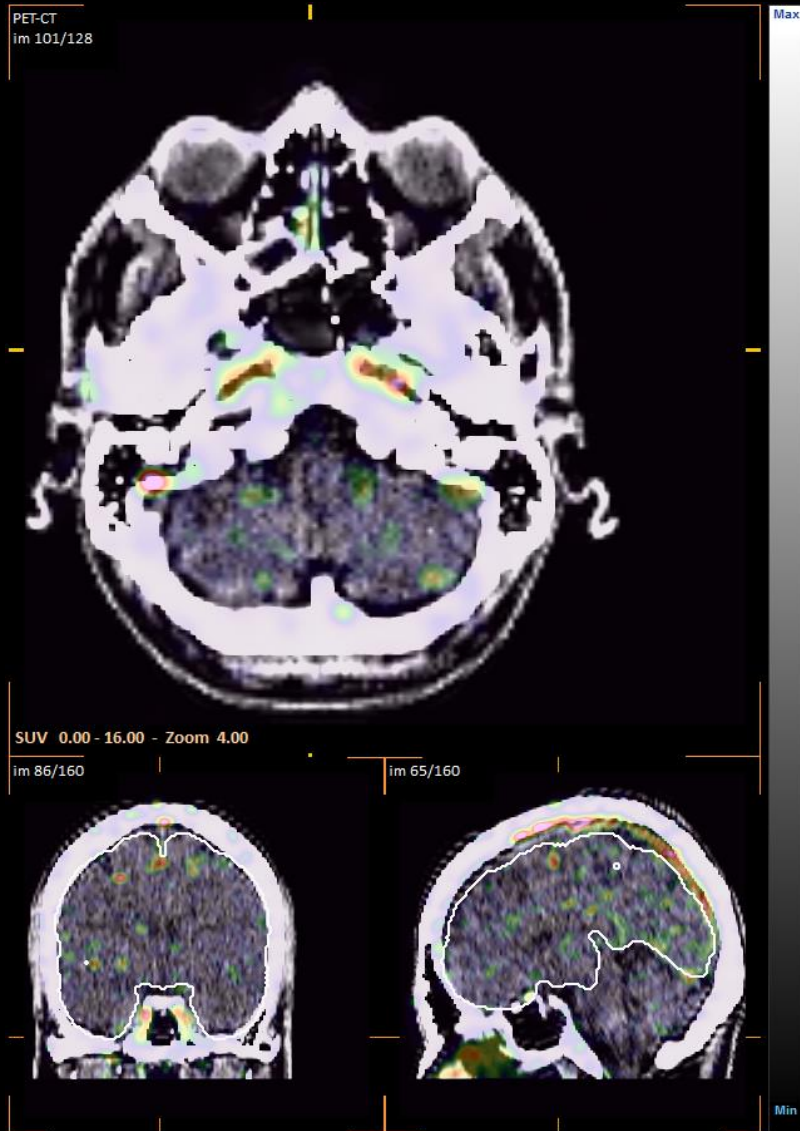
Métabolisme glucidique : ^{18}F FDG

Acquisition dynamique : 60 sec



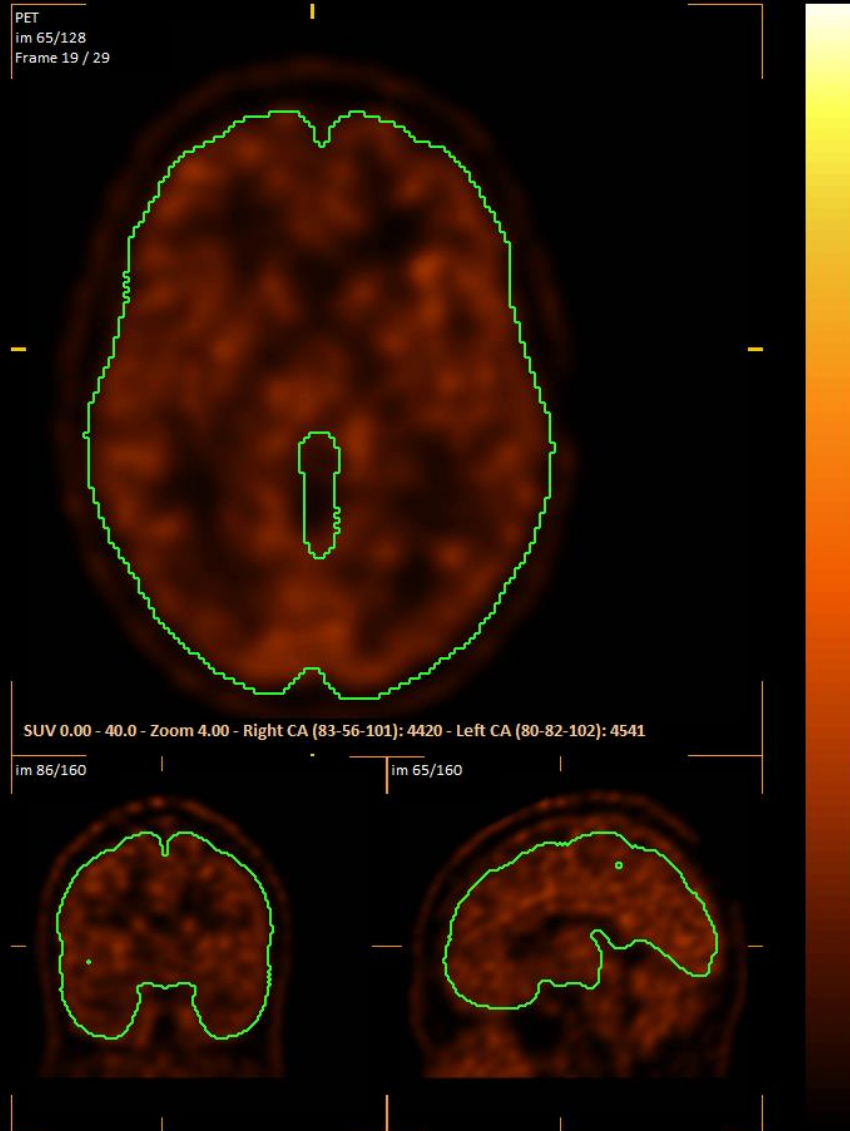
Métabolisme glucidique : ^{18}F FDG

Acquisition dynamique : 120 sec



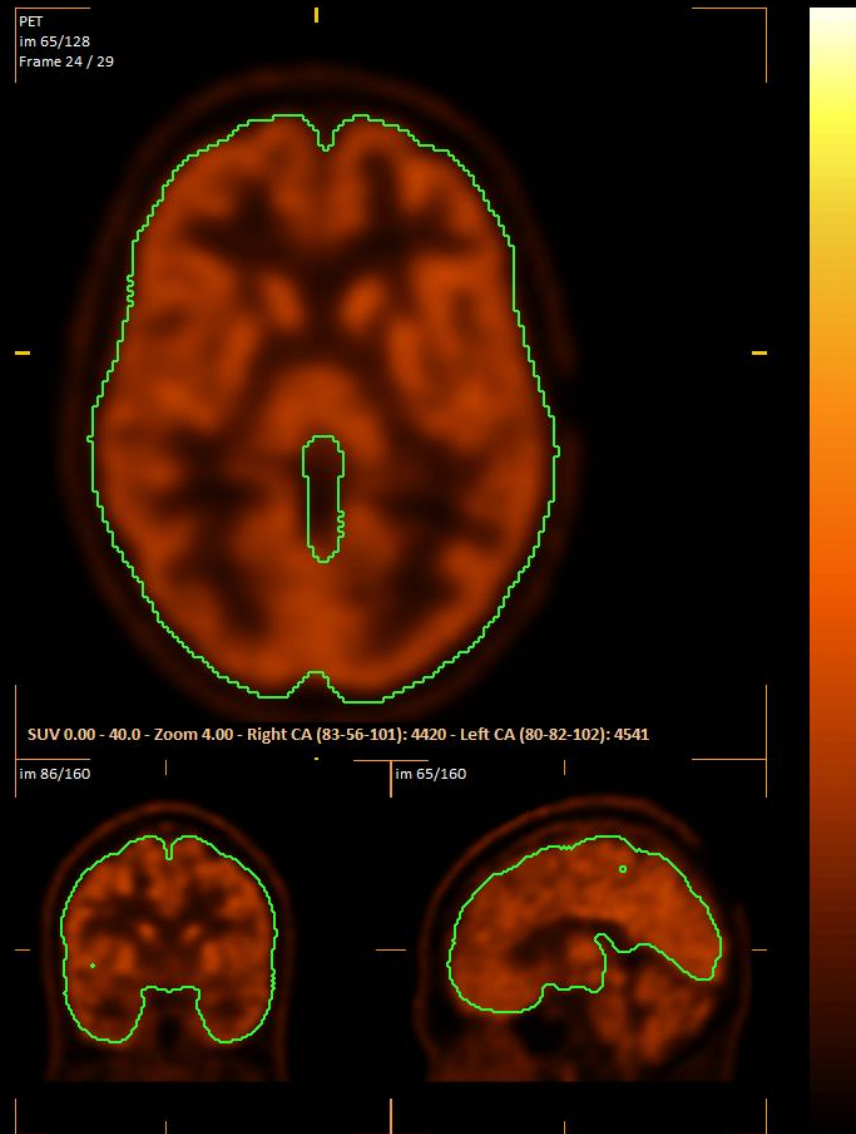
Métabolisme glucidique : ^{18}F FDG

Acquisition dynamique : 5 min



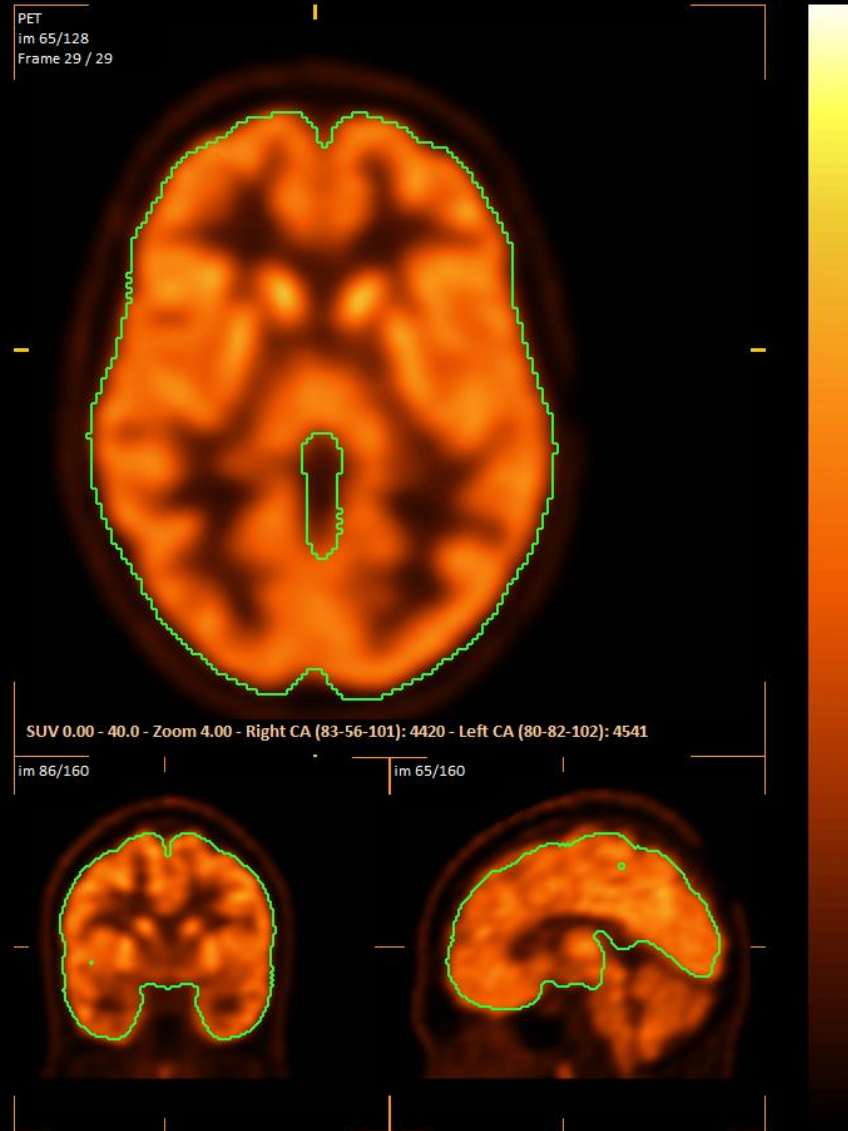
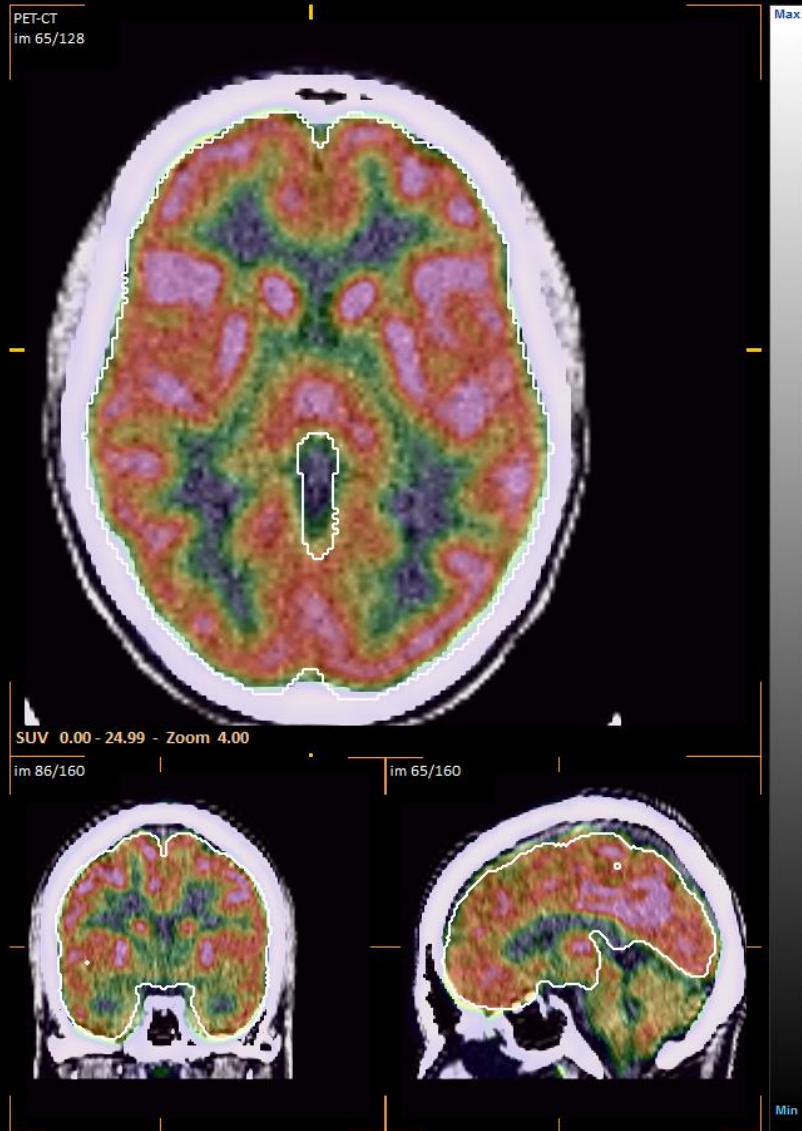
Métabolisme glucidique : ^{18}F FDG

Acquisition dynamique : 12 min

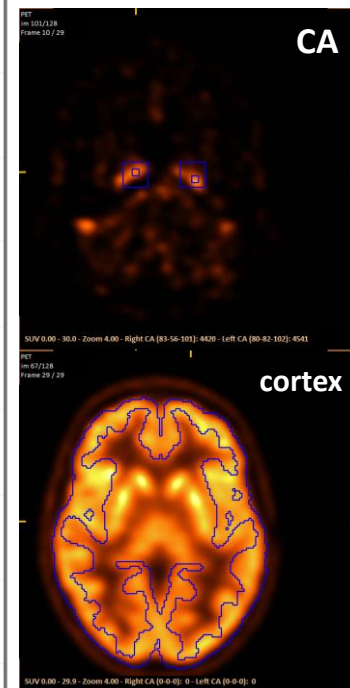
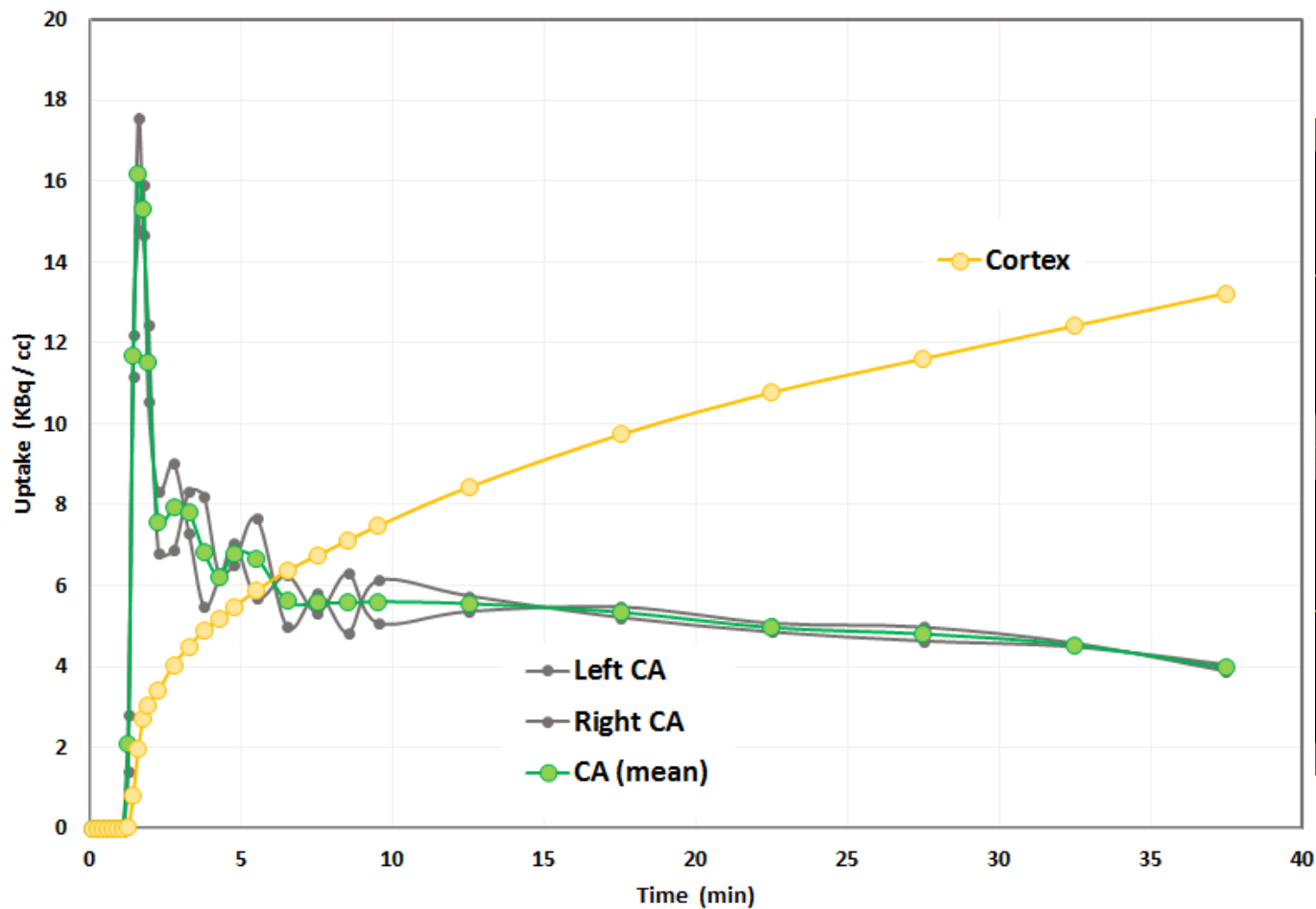


Métabolisme glucidique : ^{18}F FDG

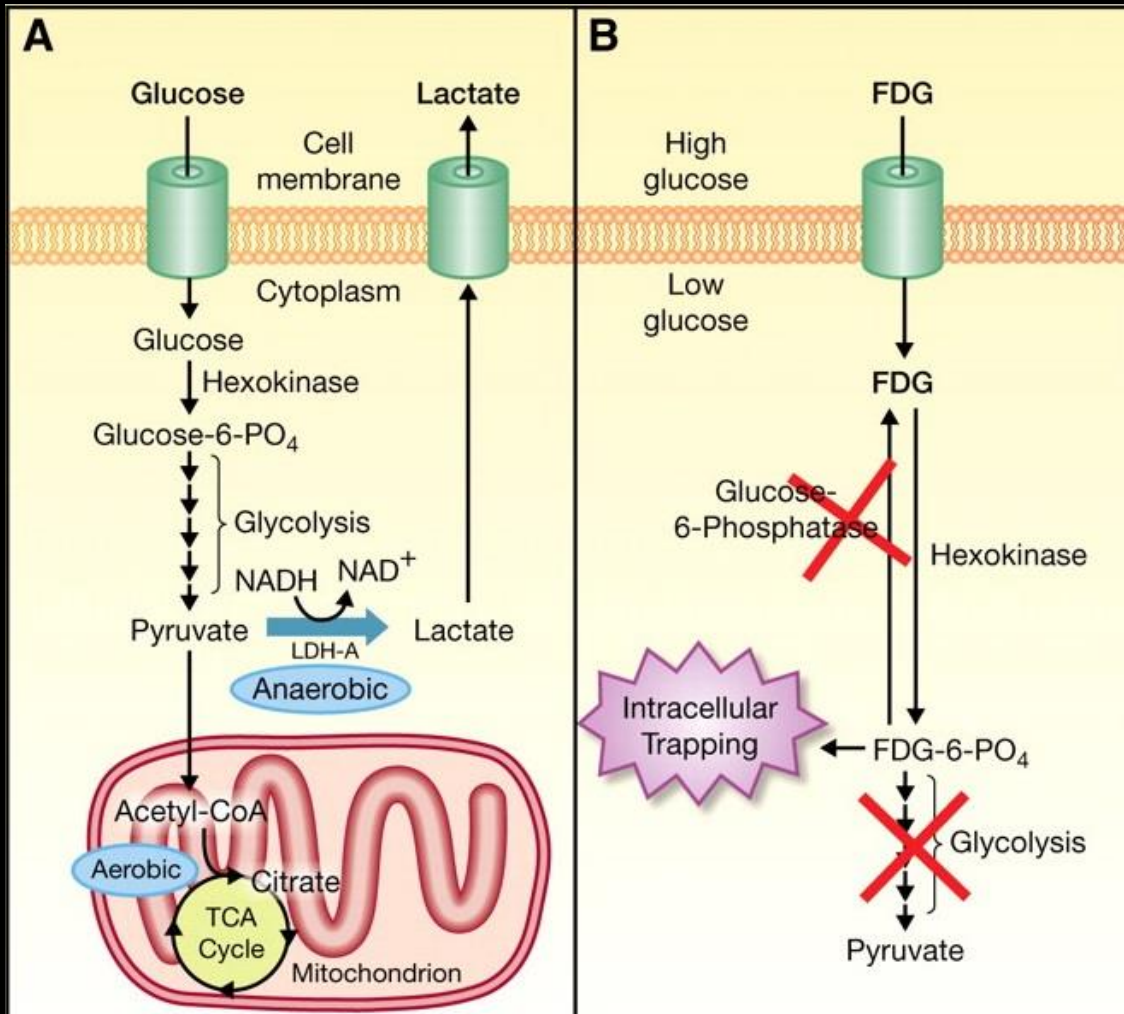
Acquisition dynamique : 35 min



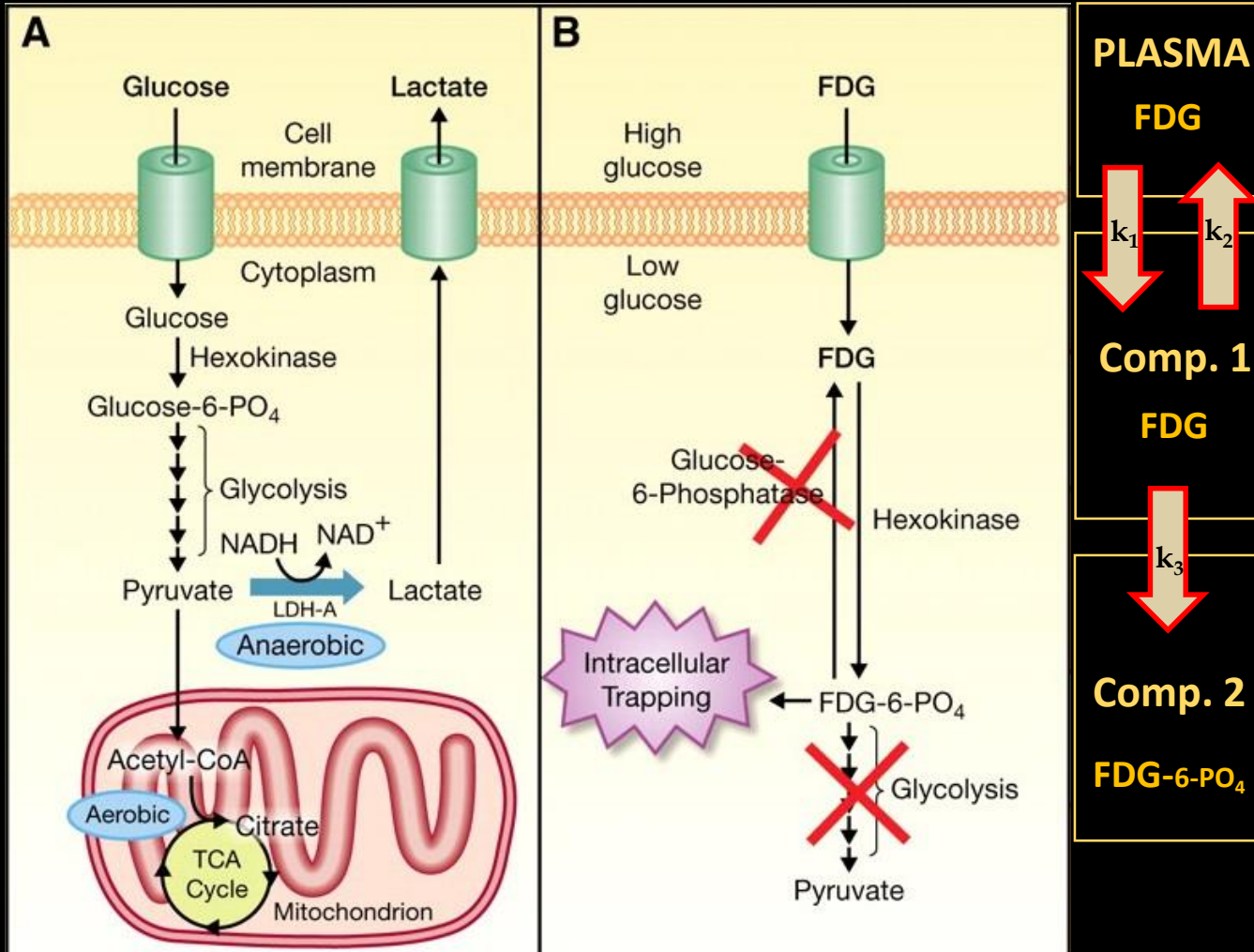
Métabolisme glucidique : ^{18}F FDG



Métabolisme glucidique : ^{18}F FDG



Métabolisme glucidique : ^{18}F FDG

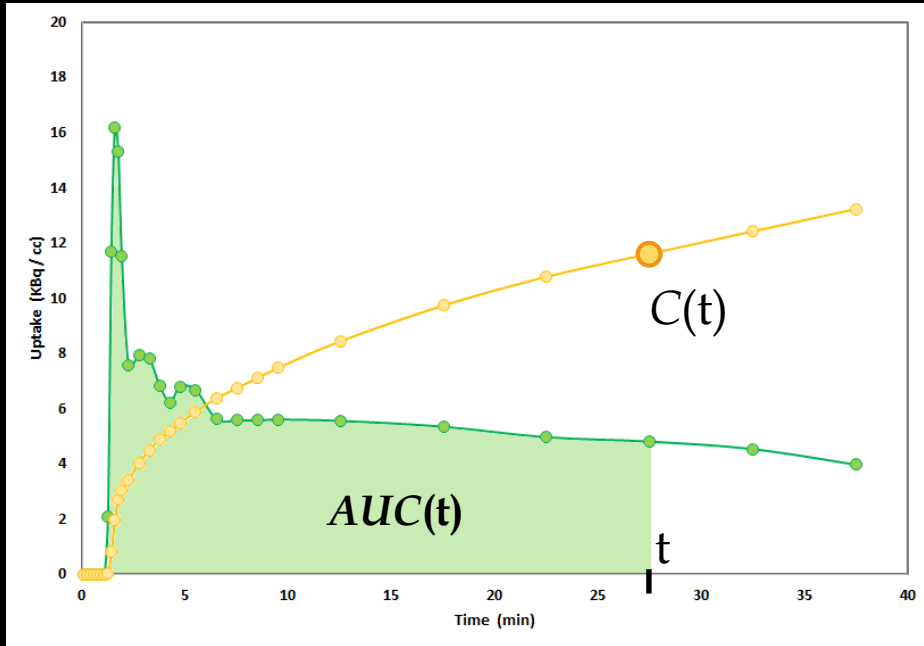


Extraction nette :

$$K_i = \frac{k_1 k_3}{k_2 + k_3}$$

$\sim 0.05 \text{ min}^{-1}$

Métabolisme glucidique : ^{18}F FDG

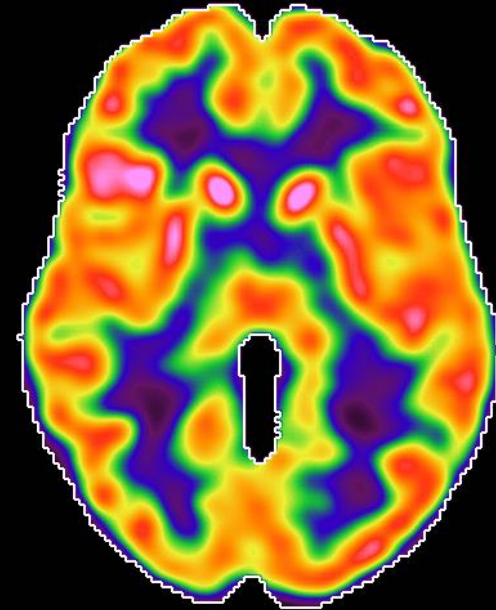


$$C(t) = K_i \times AUC(t) + \dots$$

$$\text{CMR}_{\text{glu}} = \text{glycémie} \times K_i$$

PET
im 65/128
Frame 9 / 29

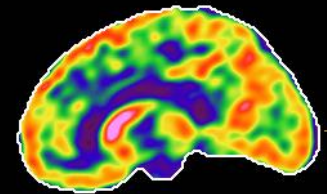
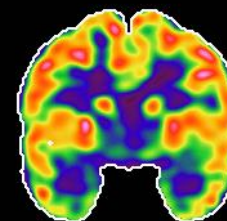
CMR_{glu}



SUV 0.00 - 0.6 - Zoom 4.00 - Right CA (83-56-101): 4420 - Left CA (80-82-102): 4541

im 86/160

im 75/160

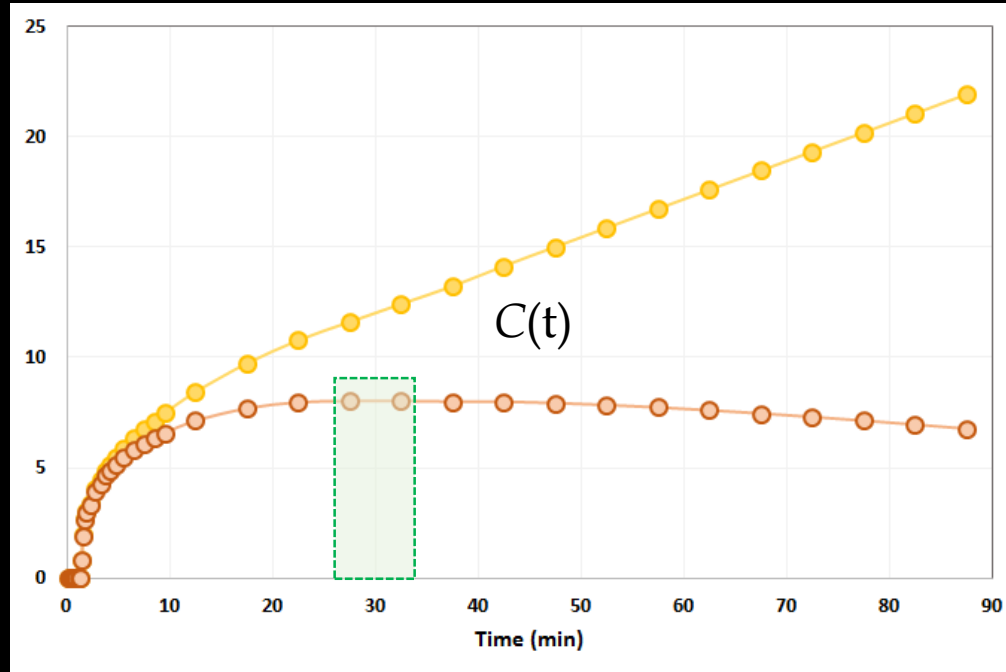


0.6

0.3

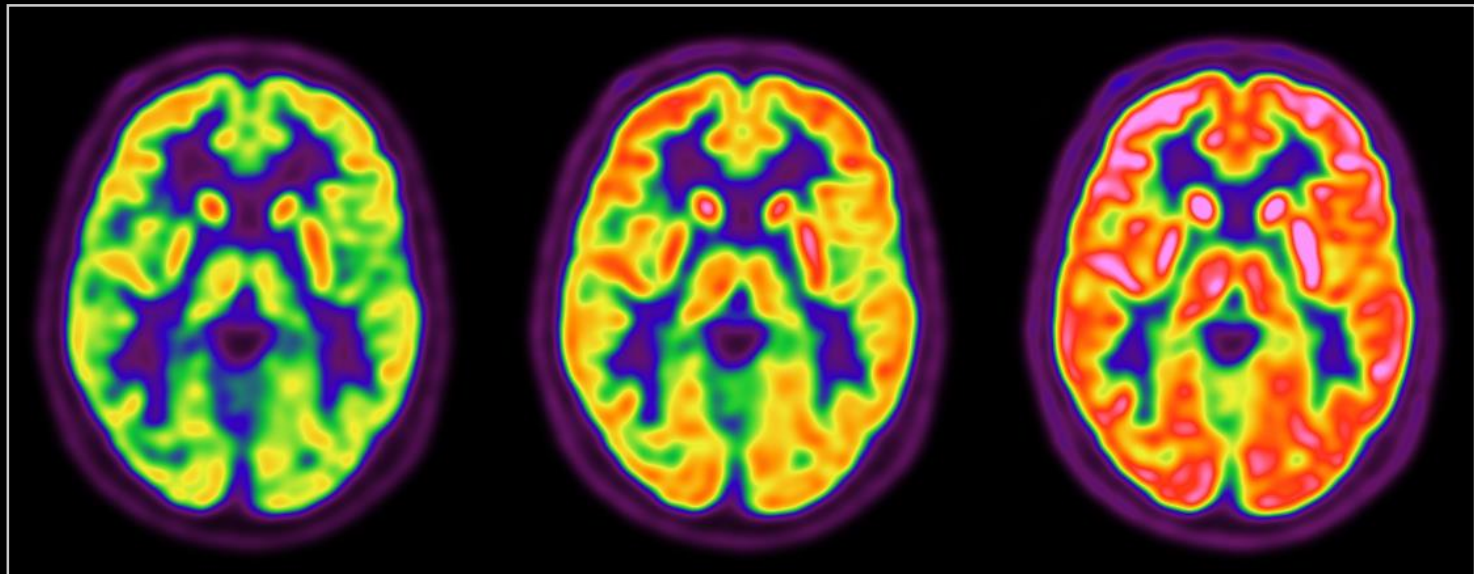
0.0

Métabolisme glucidique : ^{18}F FDG

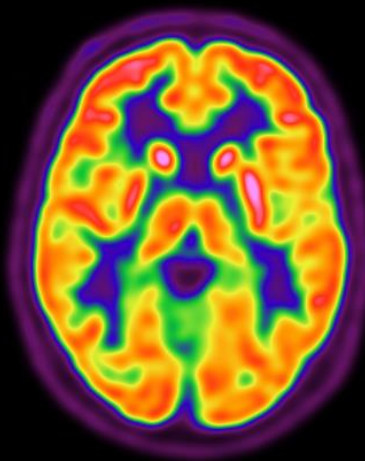


EN PRATIQUE
Une acquisition tardive
Vers 30 min
Pendant 10 min

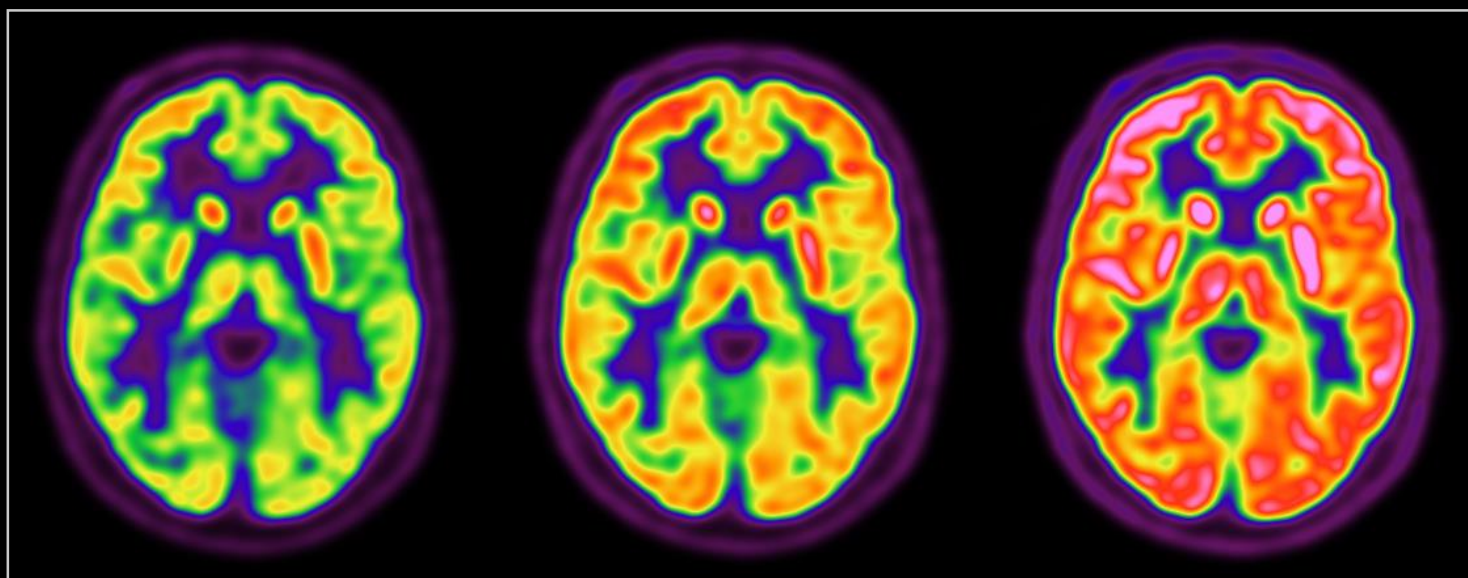
Métabolisme glucidique : ^{18}F FDG



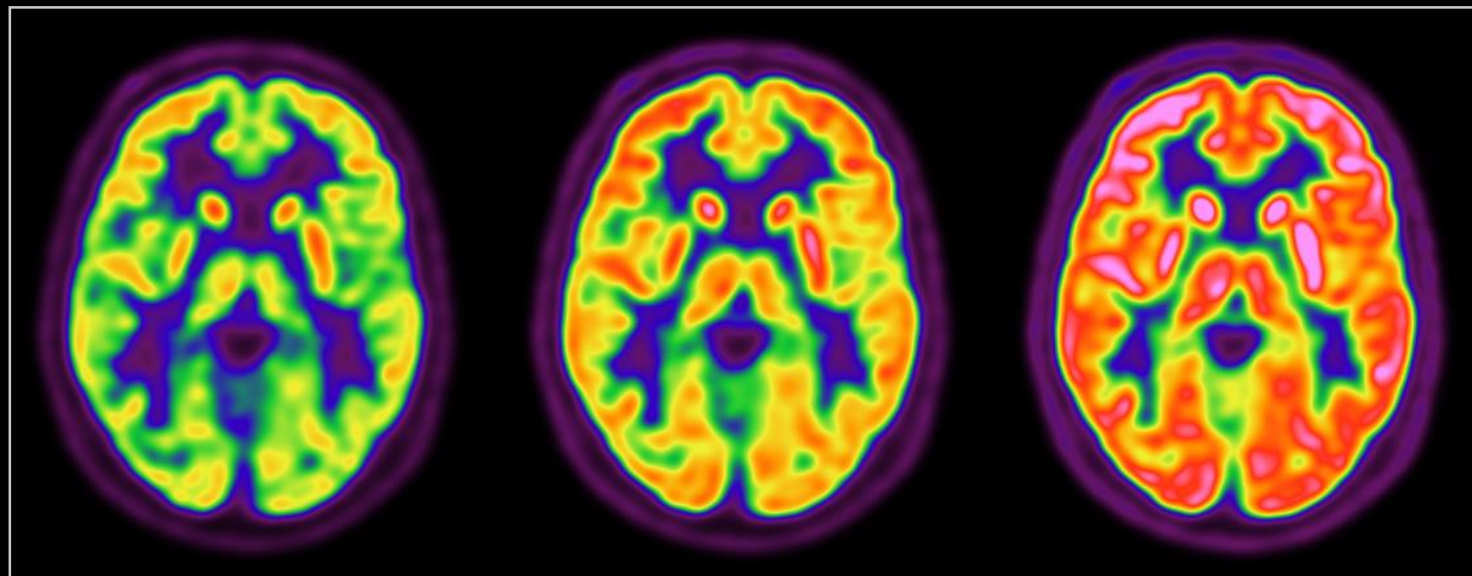
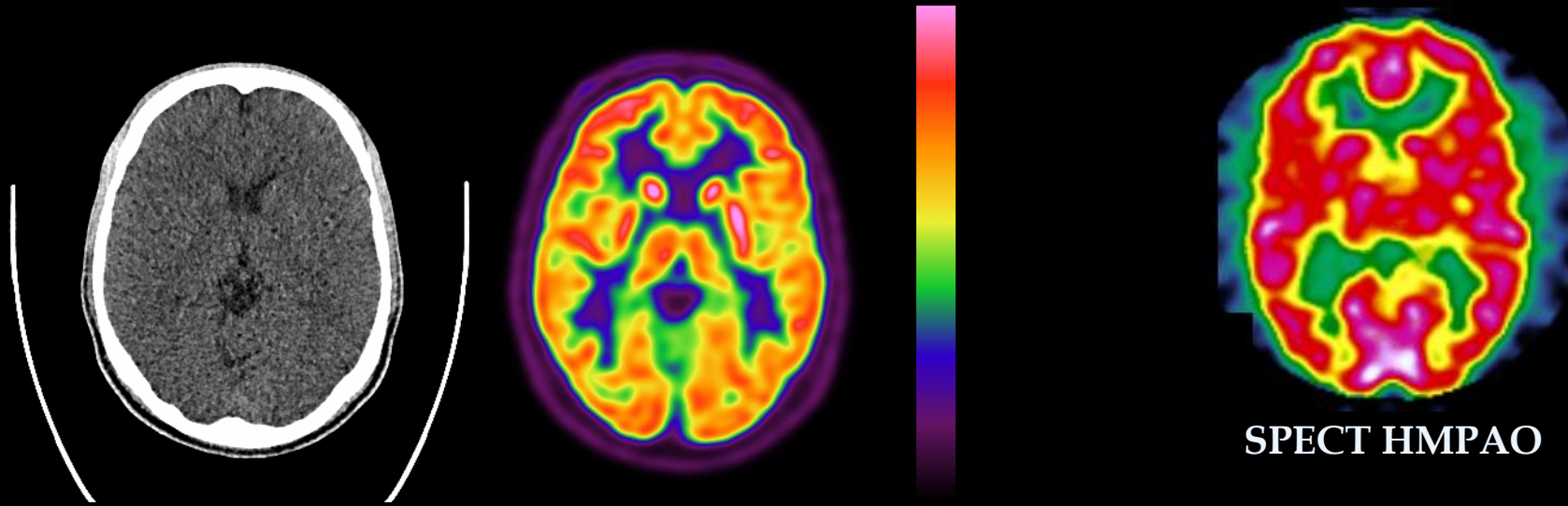
Métabolisme glucidique : ^{18}F FDG



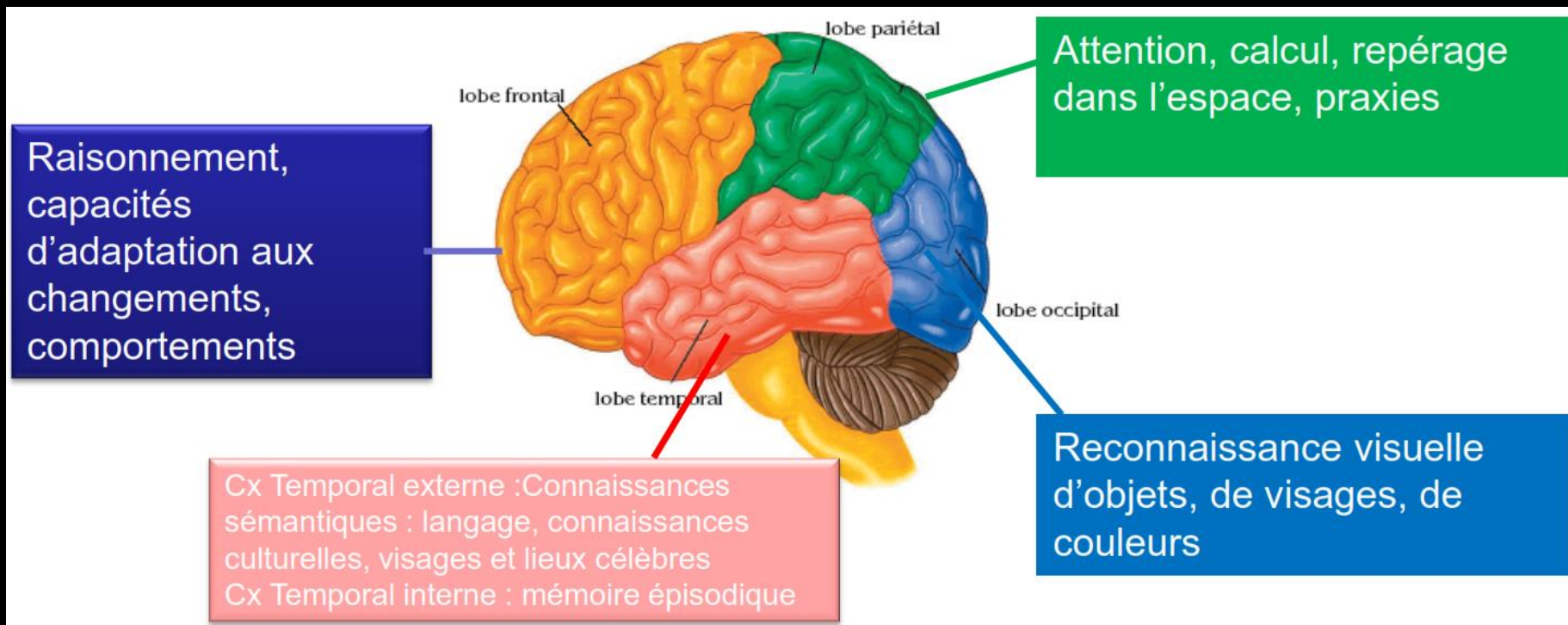
Fixation relative
Référence : NGC



Métabolisme glucidique : ^{18}F FDG



Métabolisme glucidique : ^{18}F FDG



Diagnostic positif & différentiel

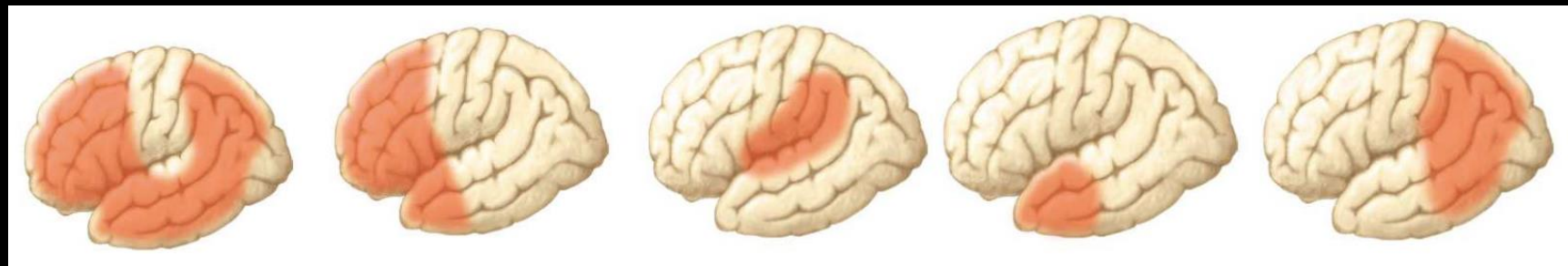
MA/DCL

DFT

APP

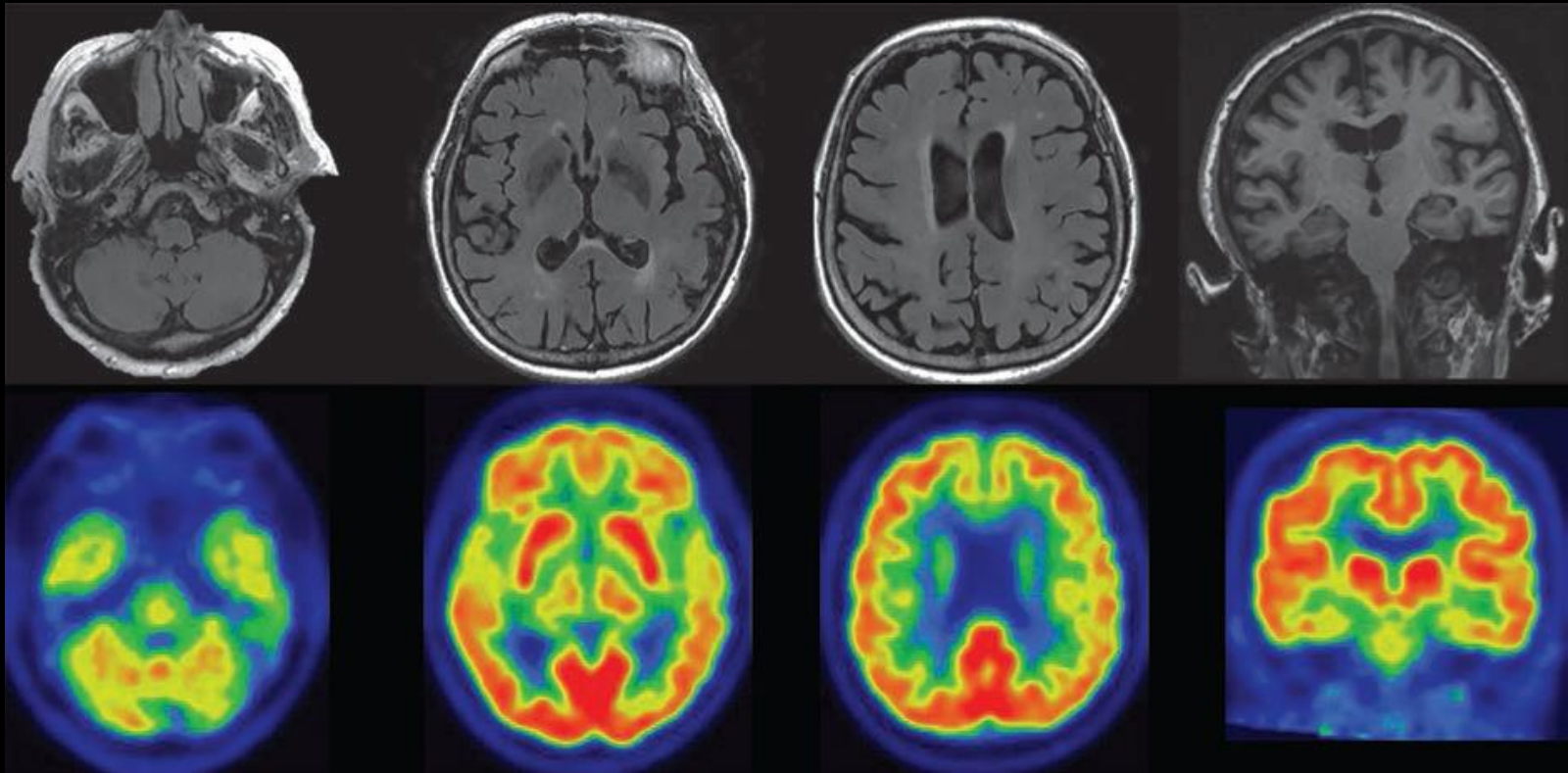
DS

ACP



Métabolisme glucidique : ^{18}F FDG

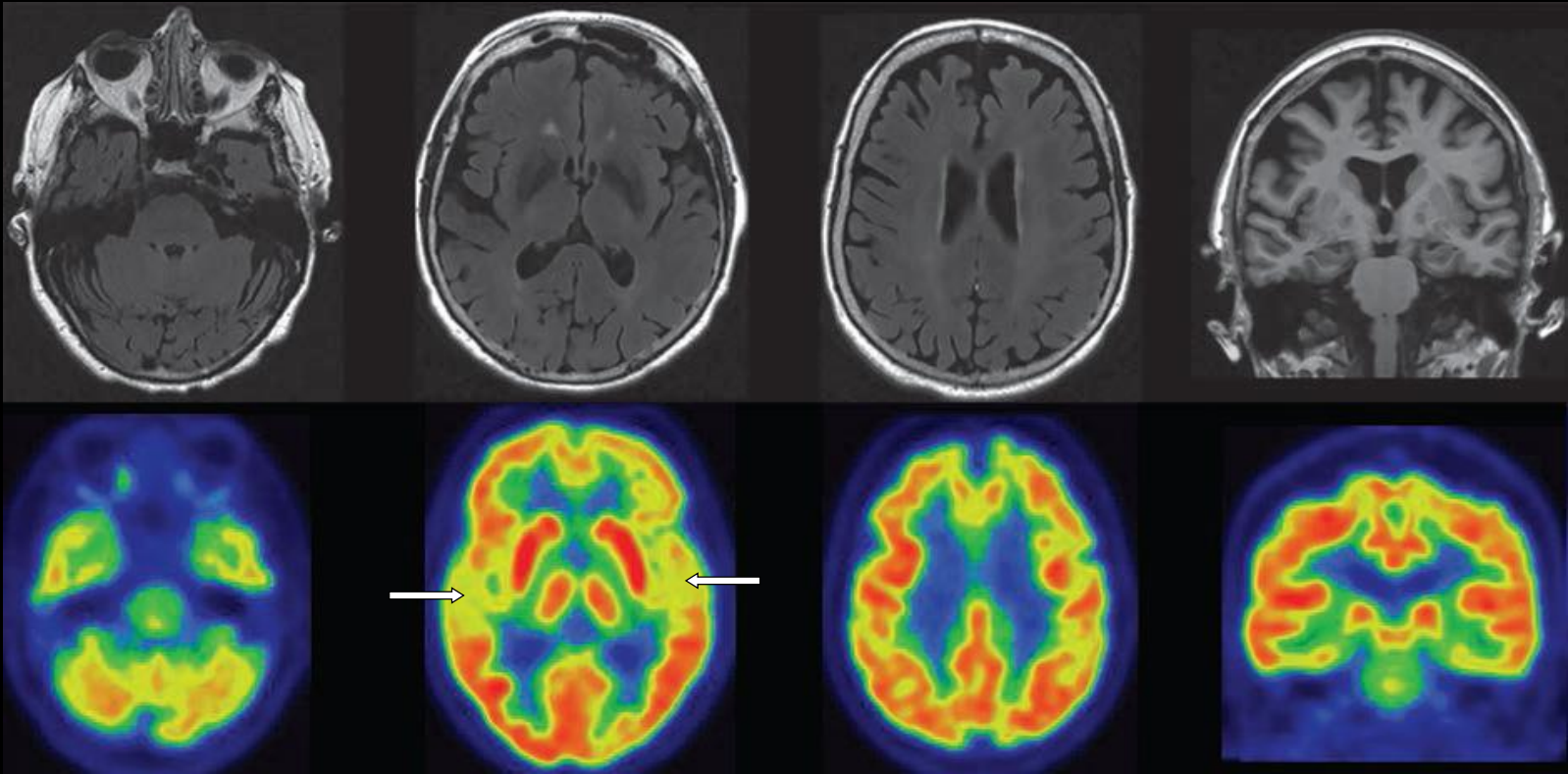
TEP FDG : *Aspect normal*



Martin-Macintosh et al. Am J Roentgenol 2016

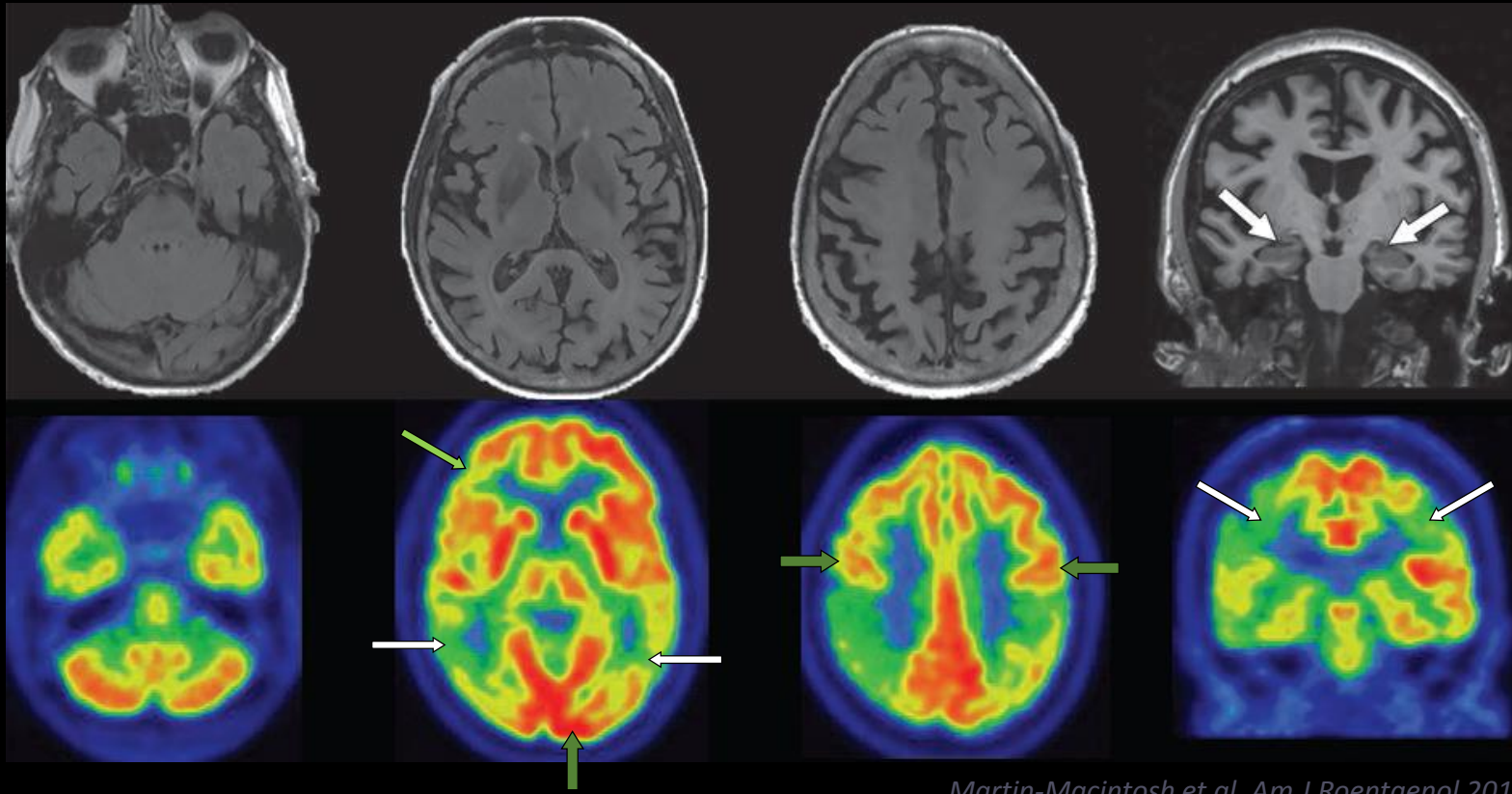
Métabolisme glucidique : ^{18}F FDG

TEP FDG : *Trouble cognitif léger (MCI)*



Métabolisme glucidique : ^{18}F FDG

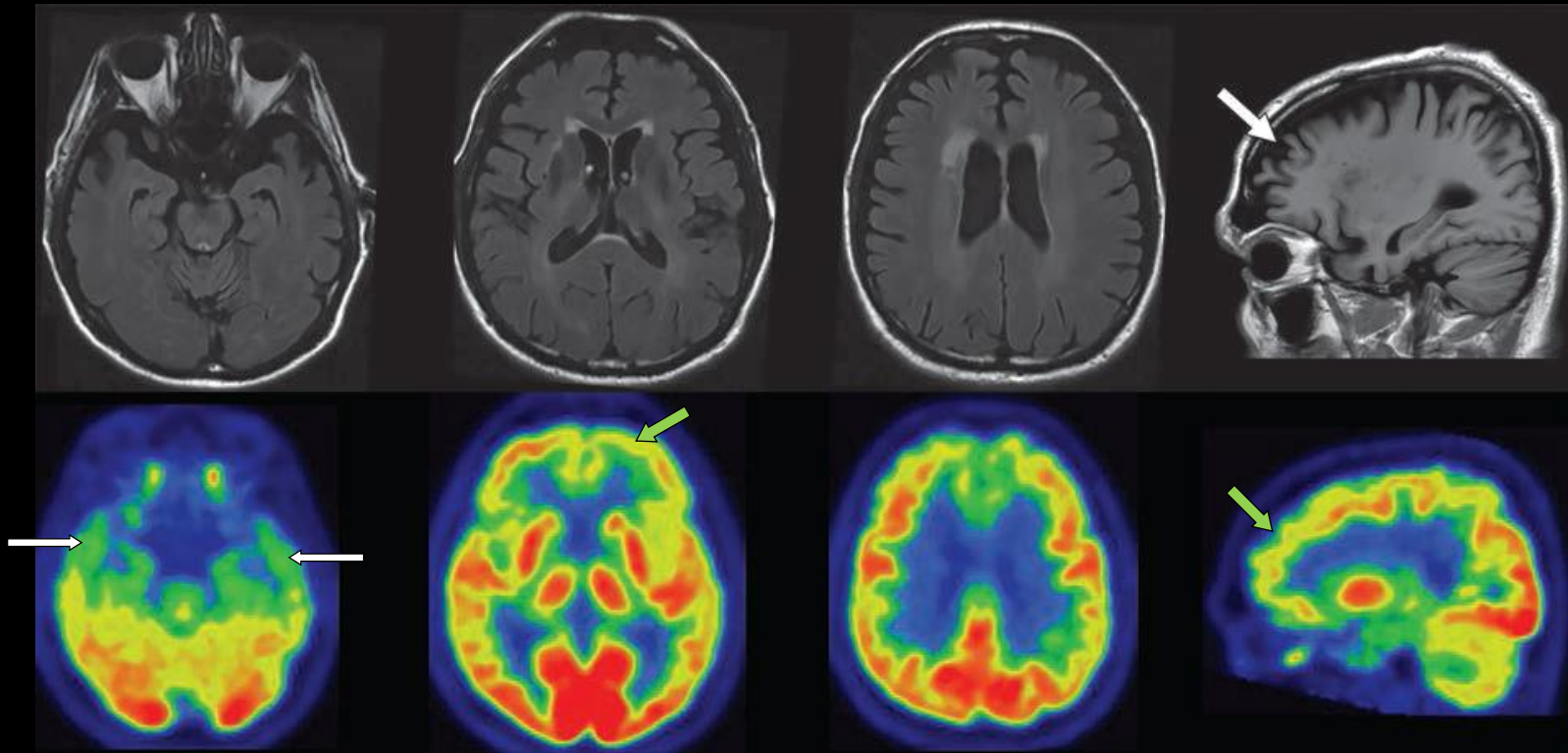
TEP FDG : *Maladie d'Alzheimer*



Martin-Macintosh et al. Am J Roentgenol 2016

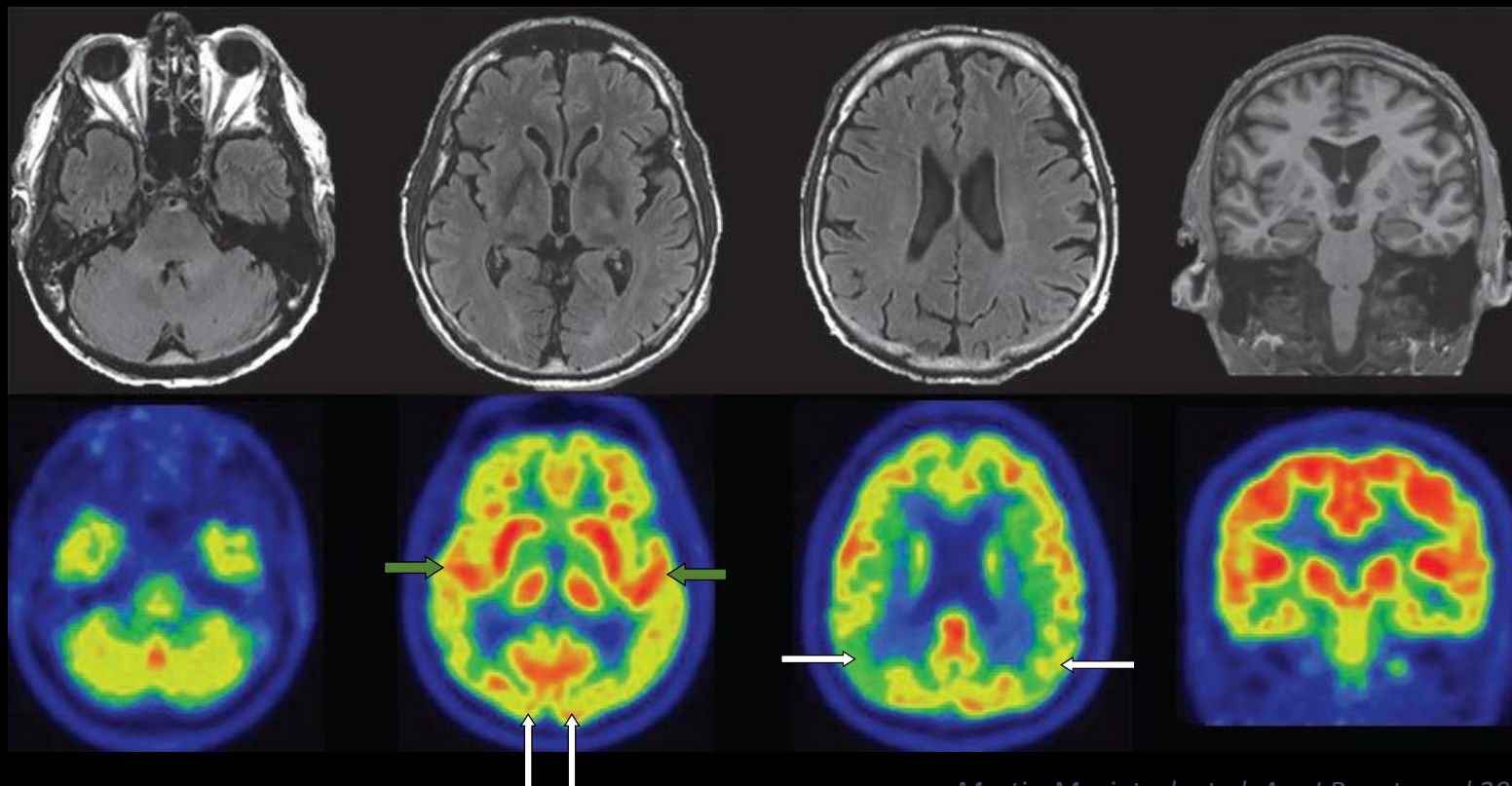
Métabolisme glucidique : ^{18}F FDG

TEP FDG : *Démence fronto-temporale*



Métabolisme glucidique : ^{18}F FDG

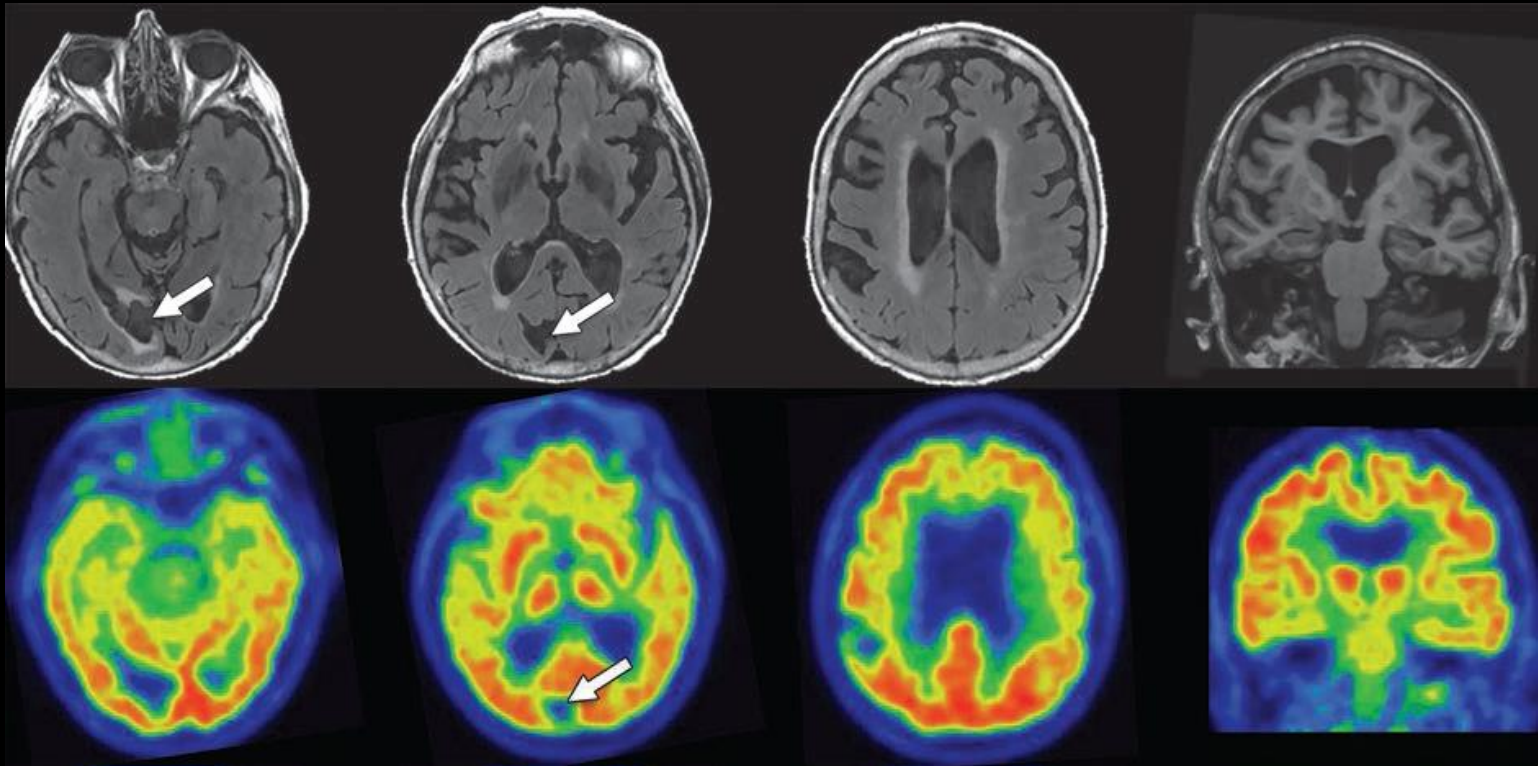
TEP FDG : *Démence à corps de Lewy diffus*



Martin-Macintosh et al. Am J Roentgenol 2016

Métabolisme glucidique : ^{18}F FDG

TEP FDG : *Démence vasculaire*

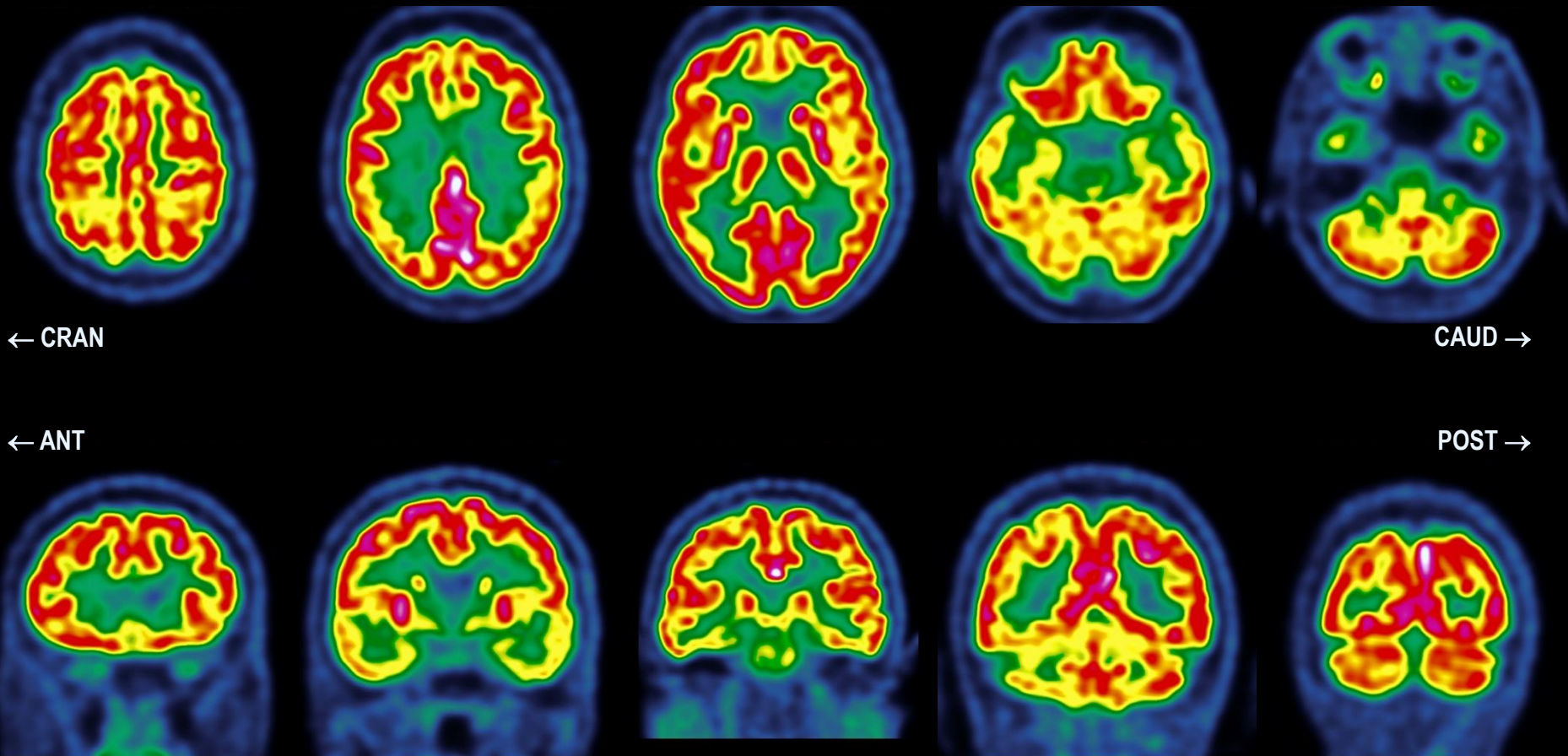


Métabolisme glucidique : ^{18}F FDG

Cas #1

Femme, 66 ans

Plainte mnésique modérée

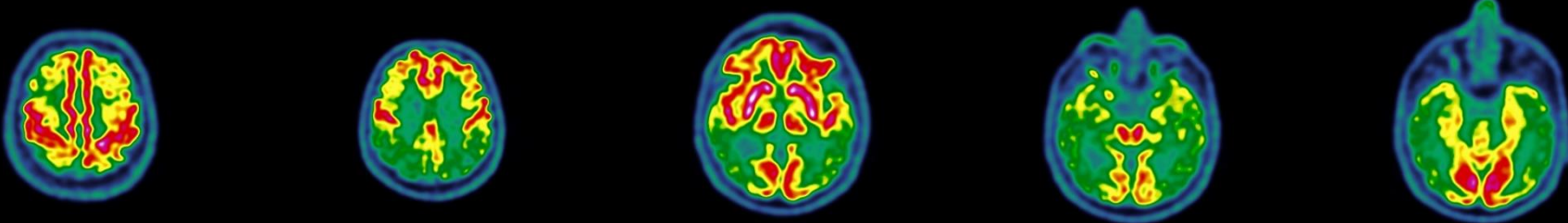


Métabolisme glucidique : ^{18}F FDG

Cas #2

Homme, 75 ans

Détérioration cognitive rapide, MMSE 22

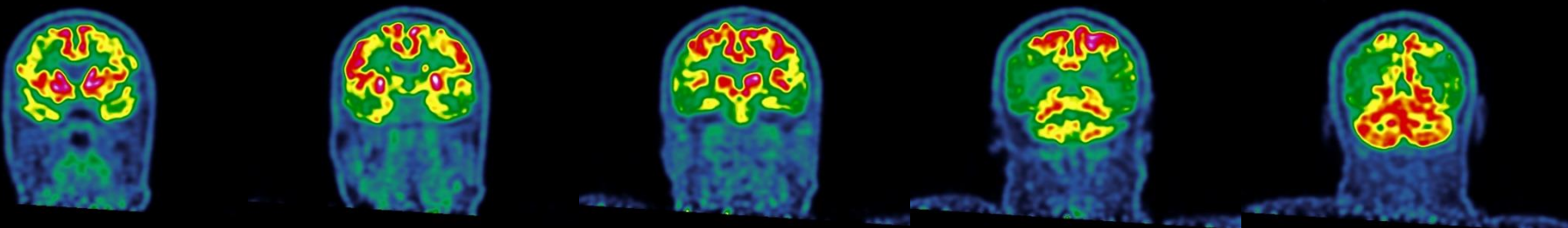


← CRAN

CAUD →

← ANT

POST →

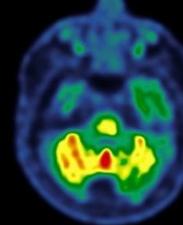
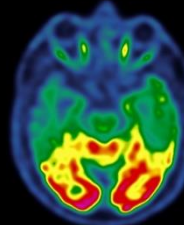
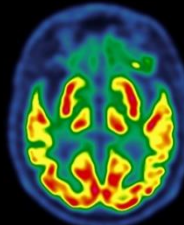
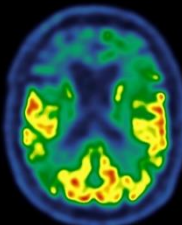
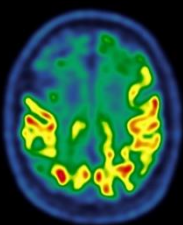
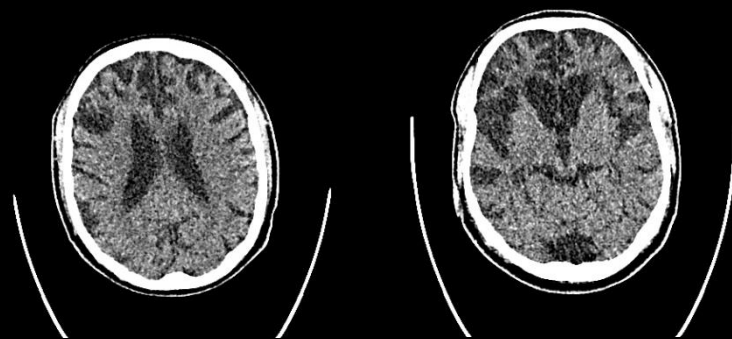


Métabolisme glucidique : ^{18}F FDG

Cas #3

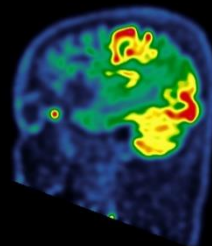
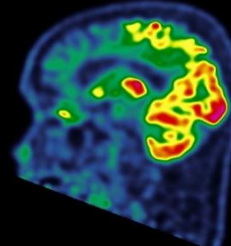
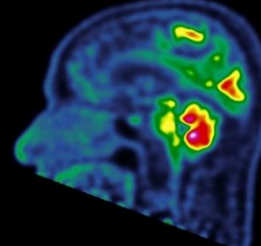
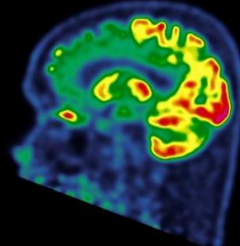
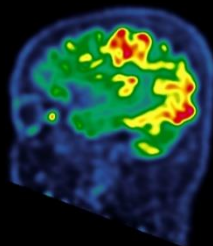
Homme, 61 ans

Troubles du comportement



← CRAN

CAUD →



← G

D →

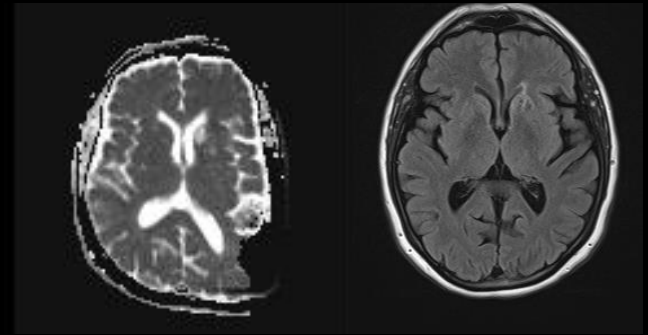
Métabolisme glucidique : ^{18}F FDG

Cas #4

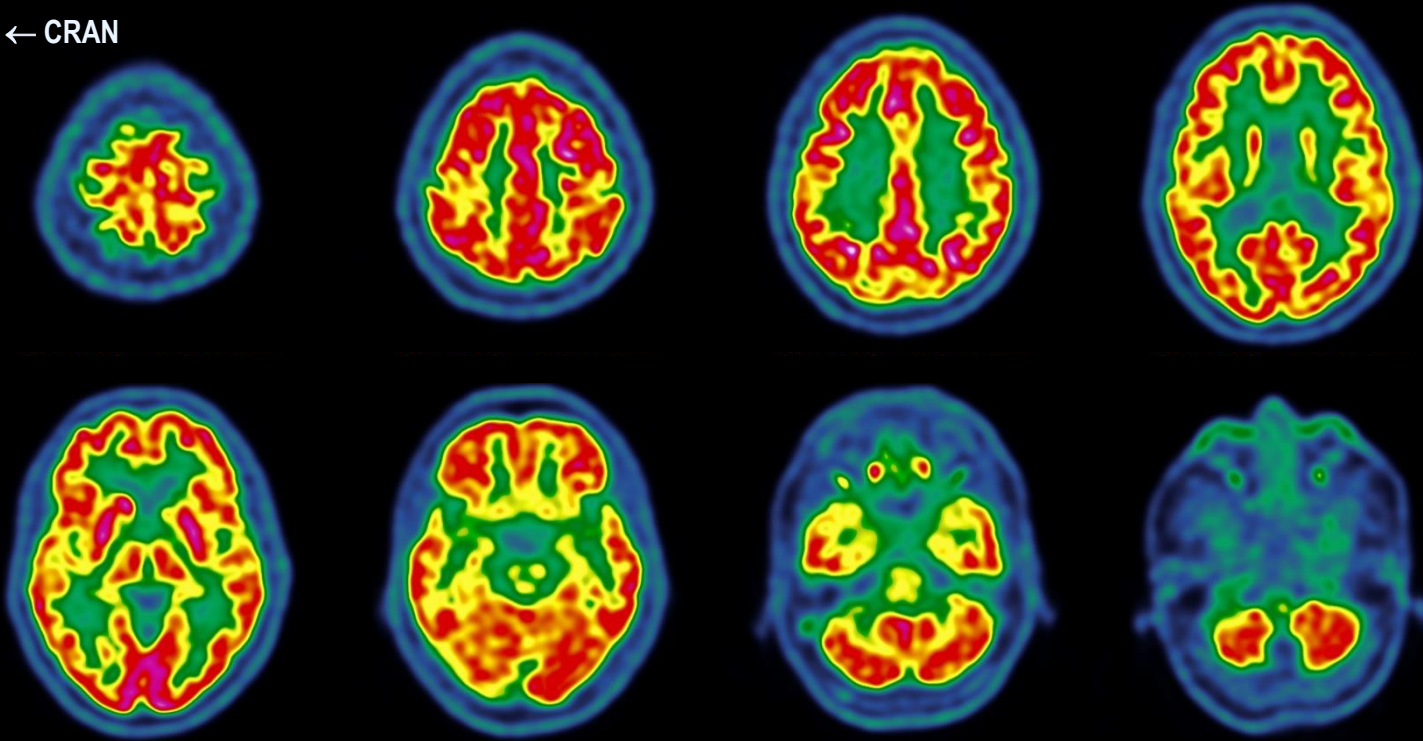
Homme, 62 ans

Plainte mnésique

Atcd...



← CRAN



CAUD →

Métabolisme glucidique : ^{18}F FDG

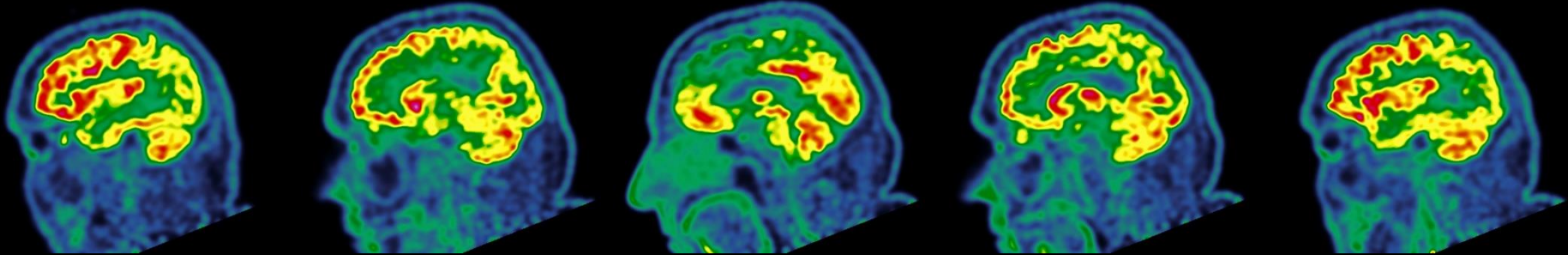
Cas #5

Homme, 61 ans

Syndrome démentiel

Syndrome extrapyramidal

← G



D →

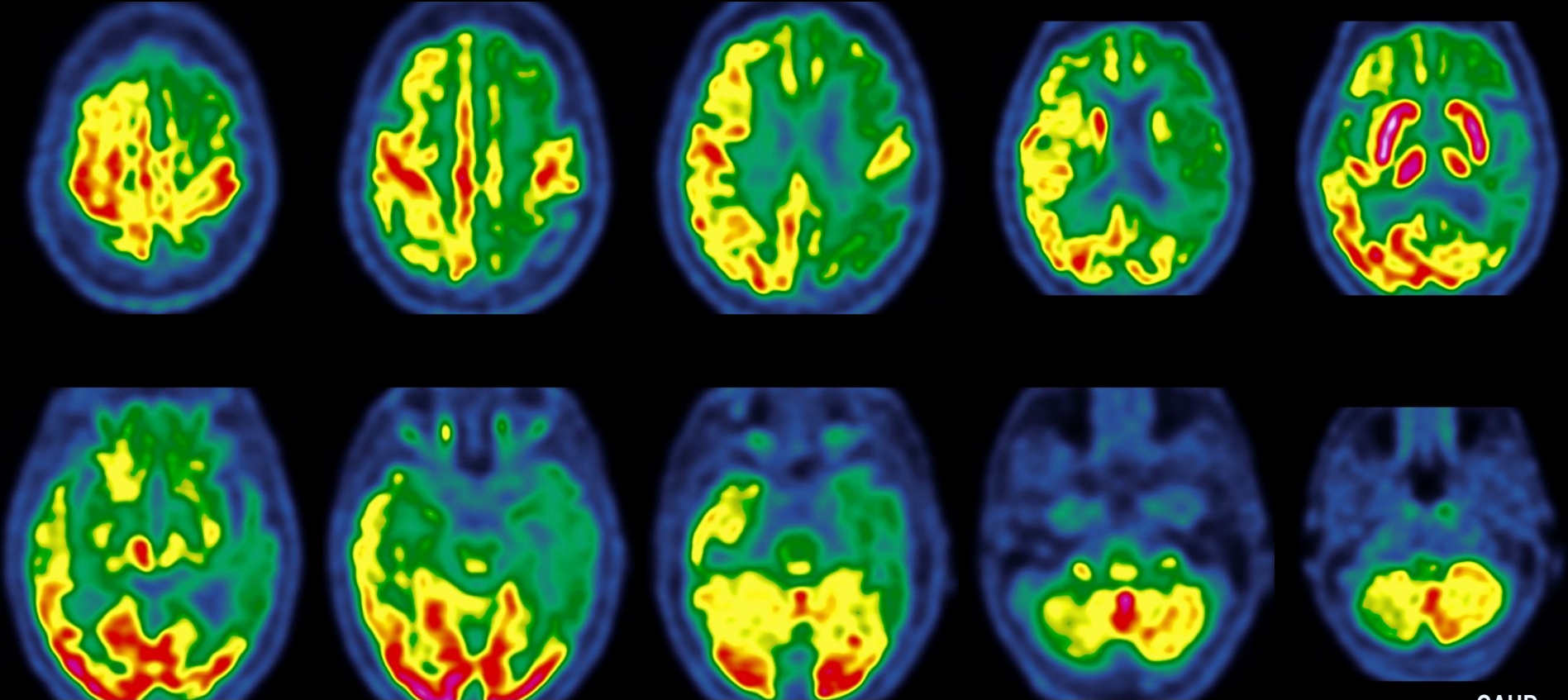
Métabolisme glucidique : ^{18}F FDG

Cas #6

Femme, 86 ans

Troubles cognitifs et phasiques depuis 2 ans

← CRAN



CAUD →

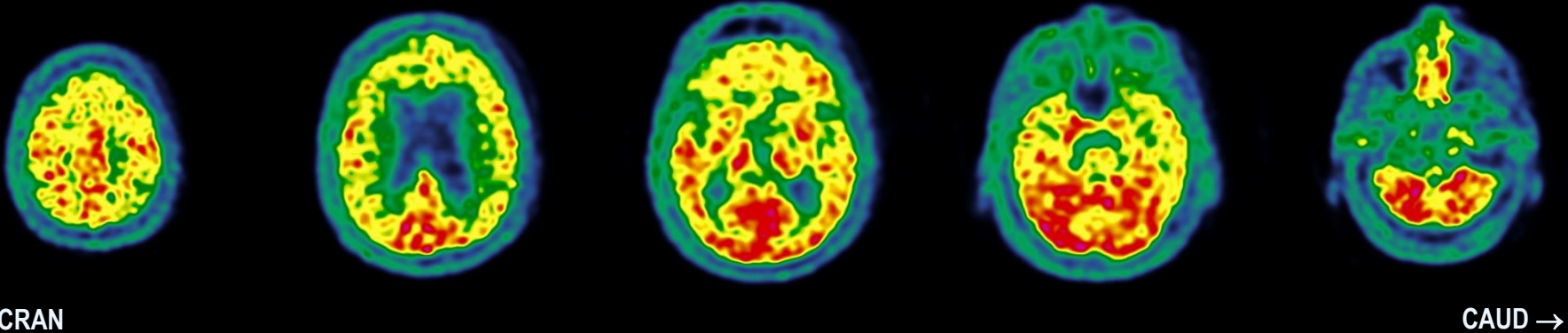
Métabolisme glucidique : ^{18}F FDG

Cas #7

Homme, 81 ans

Troubles mémoire épisodique

Diabète déséquilibré



Métabolisme glucidique : ^{18}F FDG

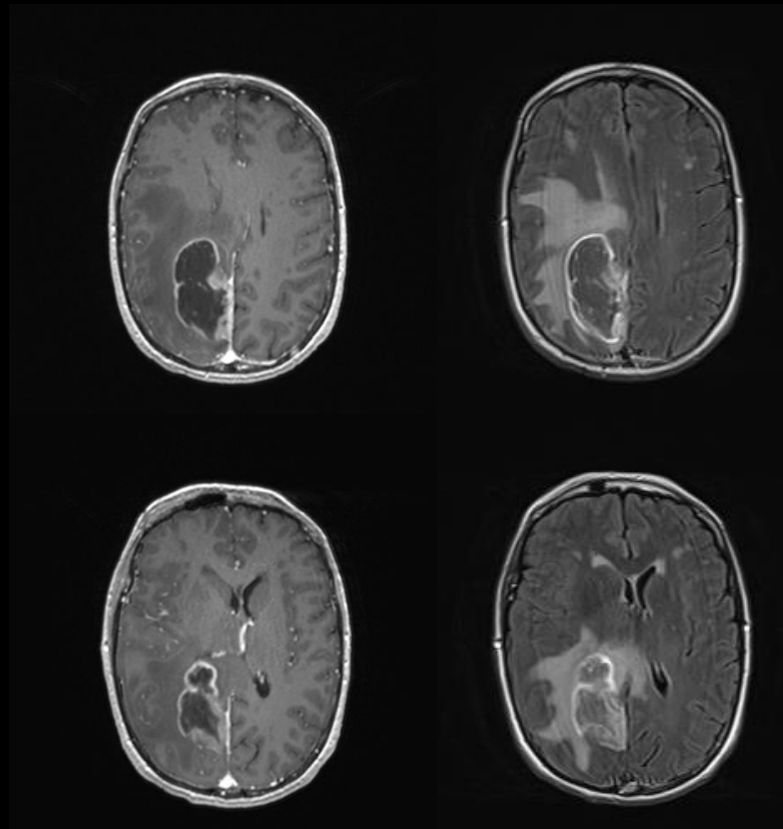
Cas #8

Homme, 72 ans

ADK pulmonaire

découvert sur méta cérébrale

11 juin 2016



Métabolisme glucidique : ^{18}F FDG

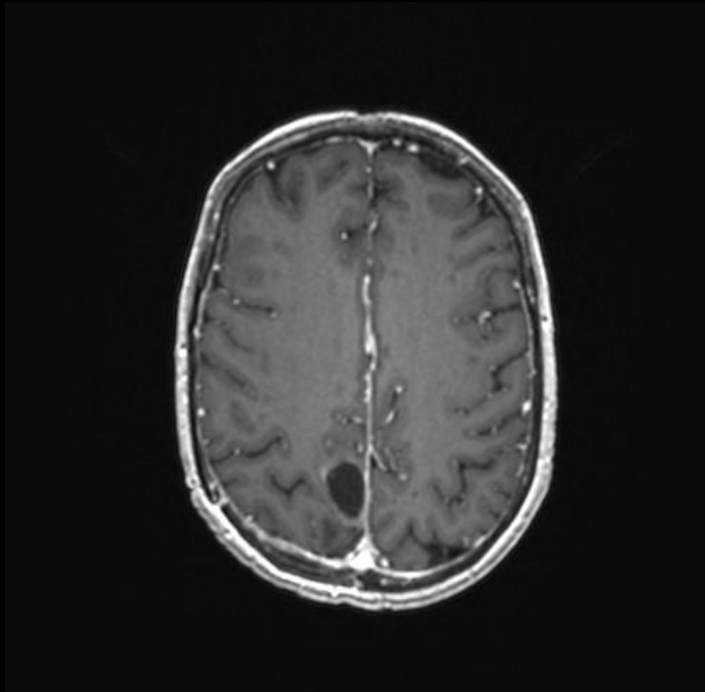
Cas #8

Homme, 72 ans

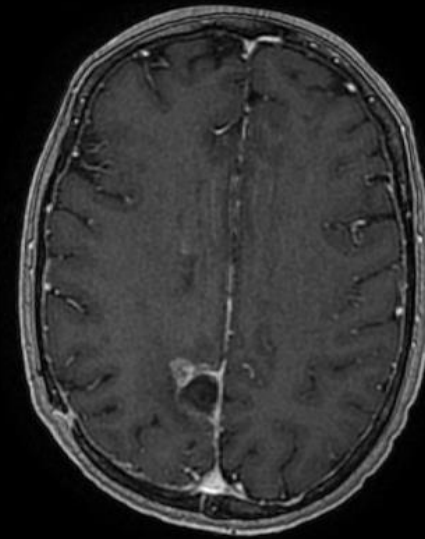
ADK pulmonaire

découvert sur méta cérébrale

10 oct. 2016



16 mars 2017



Métabolisme glucidique : ^{18}F FDG

Cas #8

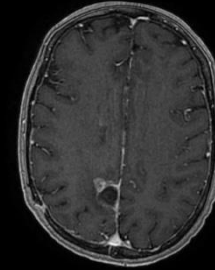
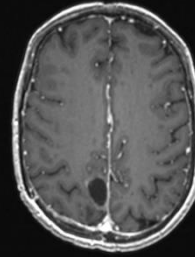
Homme, 72 ans

ADK pulmonaire

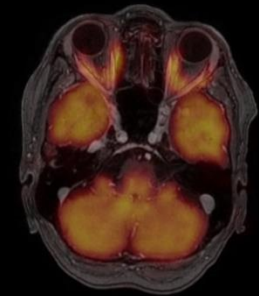
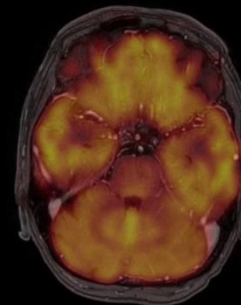
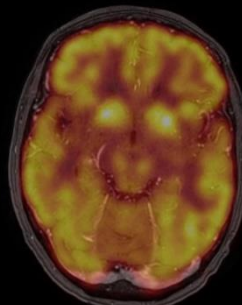
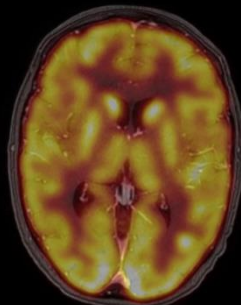
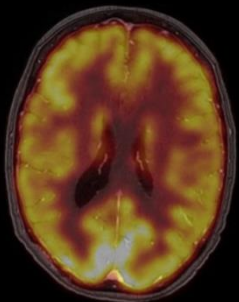
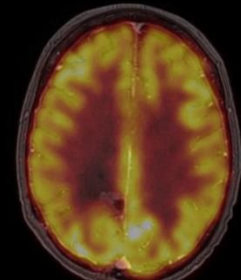
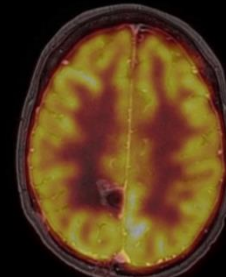
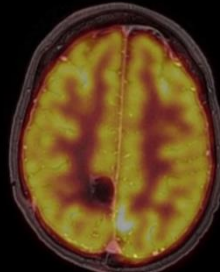
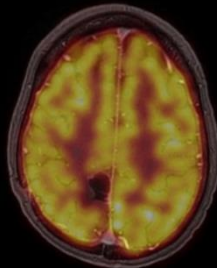
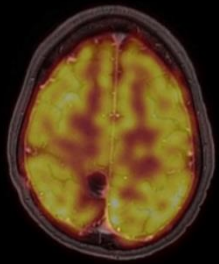
découvert sur méta cérébrale

10 oct. 2016

16 mars 2017



← CRAN



CAUD →

Métabolisme glucidique : ^{18}F FDG

Cas #8

Homme, 72 ans

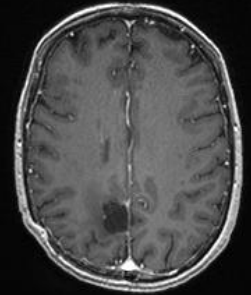
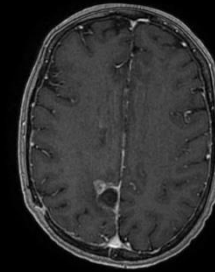
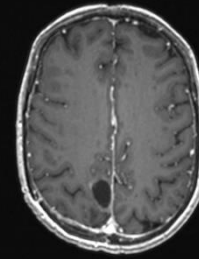
ADK pulmonaire

découvert sur méta cérébrale

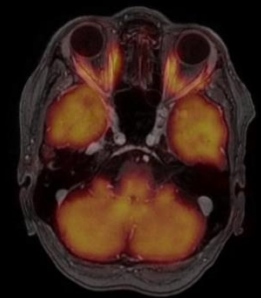
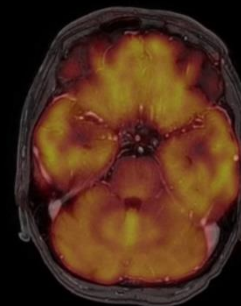
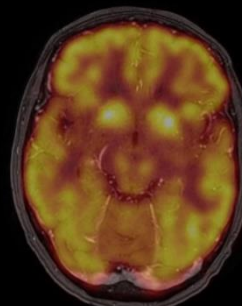
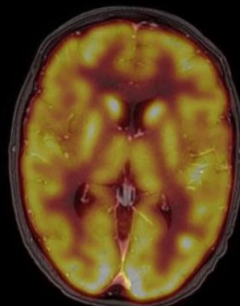
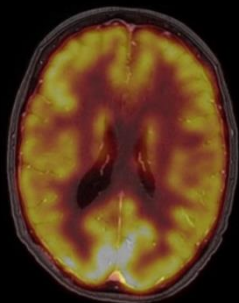
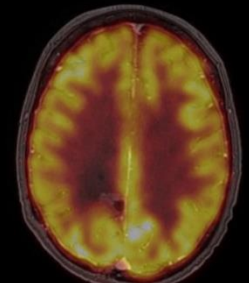
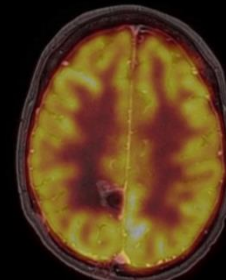
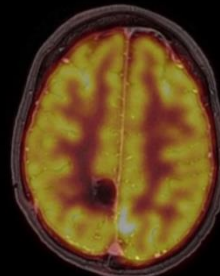
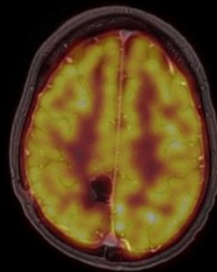
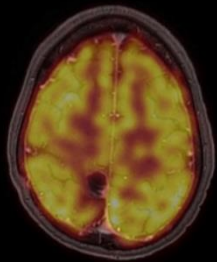
10 oct. 2016

16 mars 2017

18 sept. 2017



← CRAN

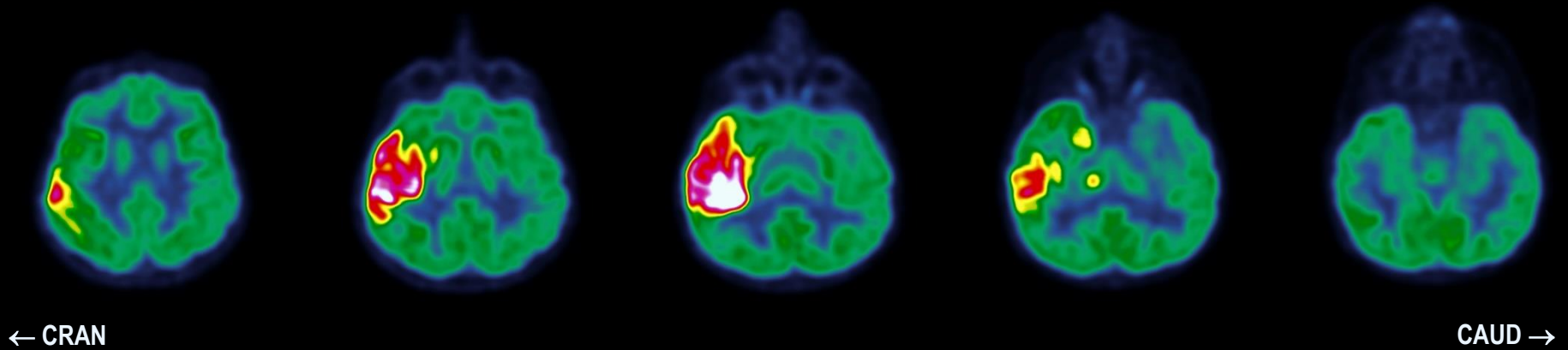


CAUD →

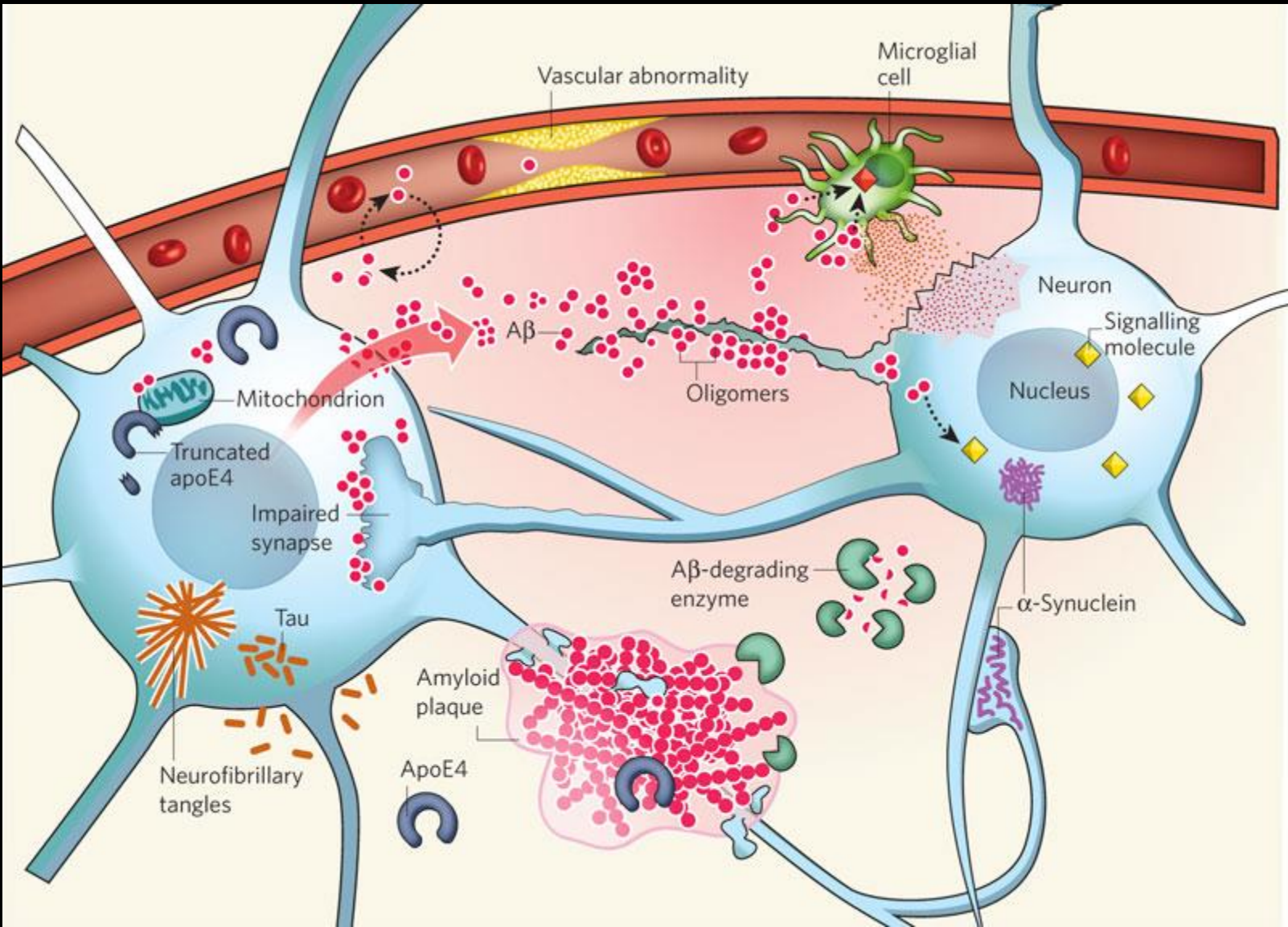
Métabolisme glucidique : ^{18}F FDG

Cas #9

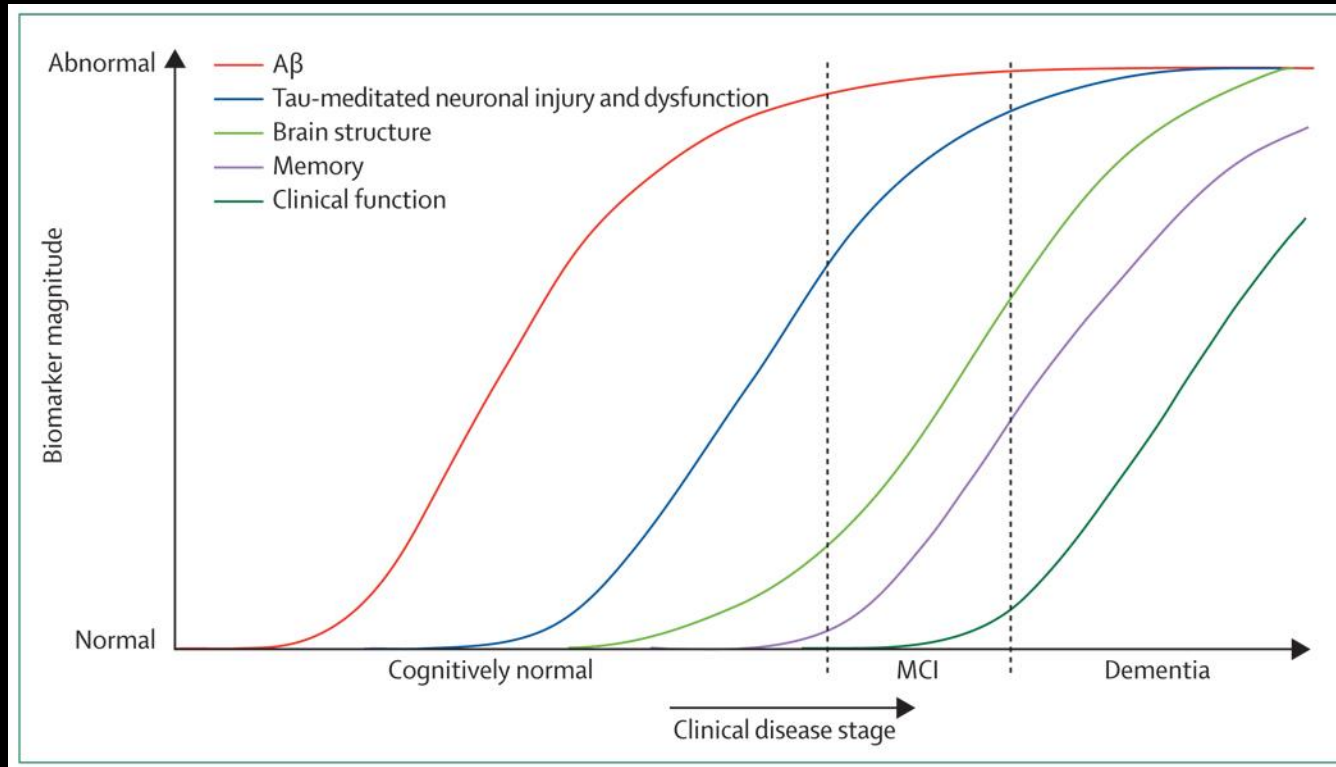
Enfant, 3 ans



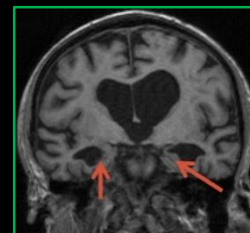
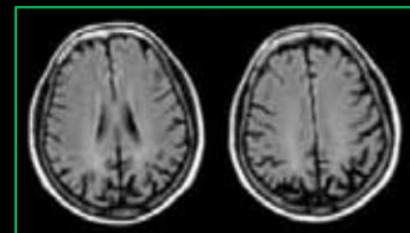
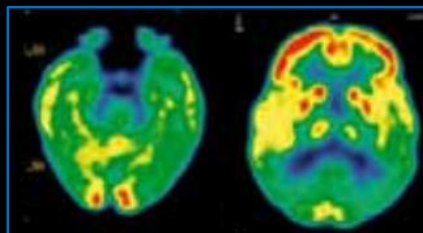
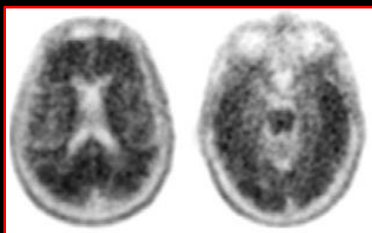
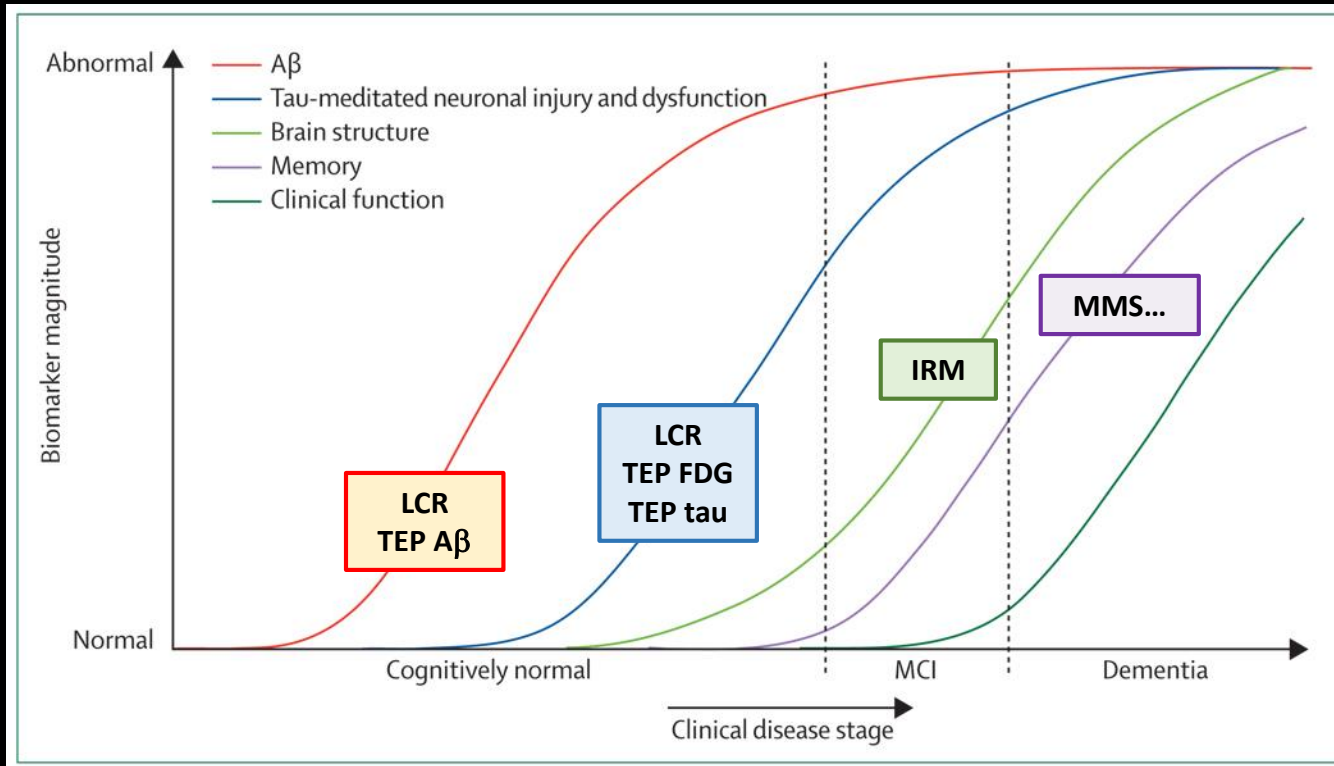
Amyloidopathie / tauopathie



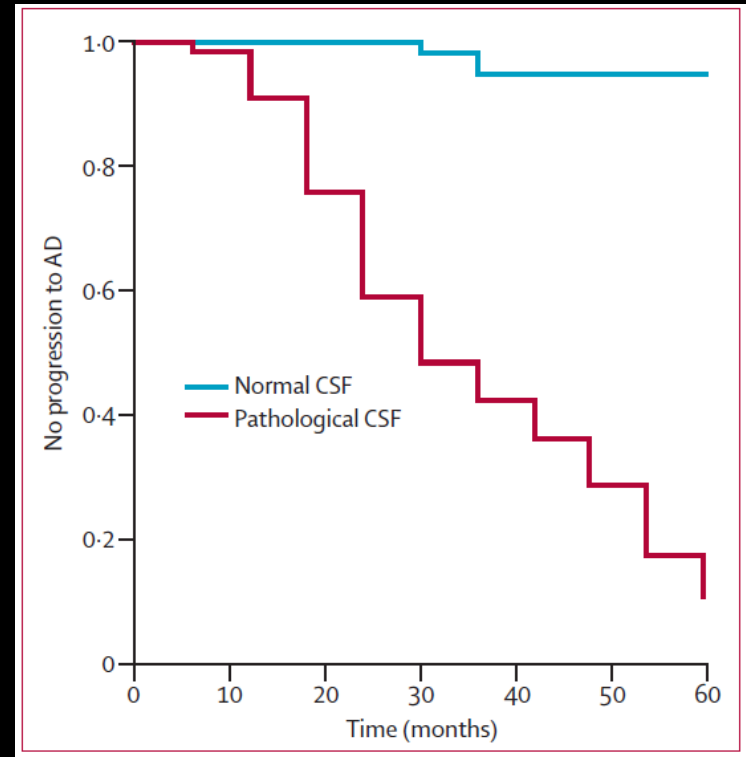
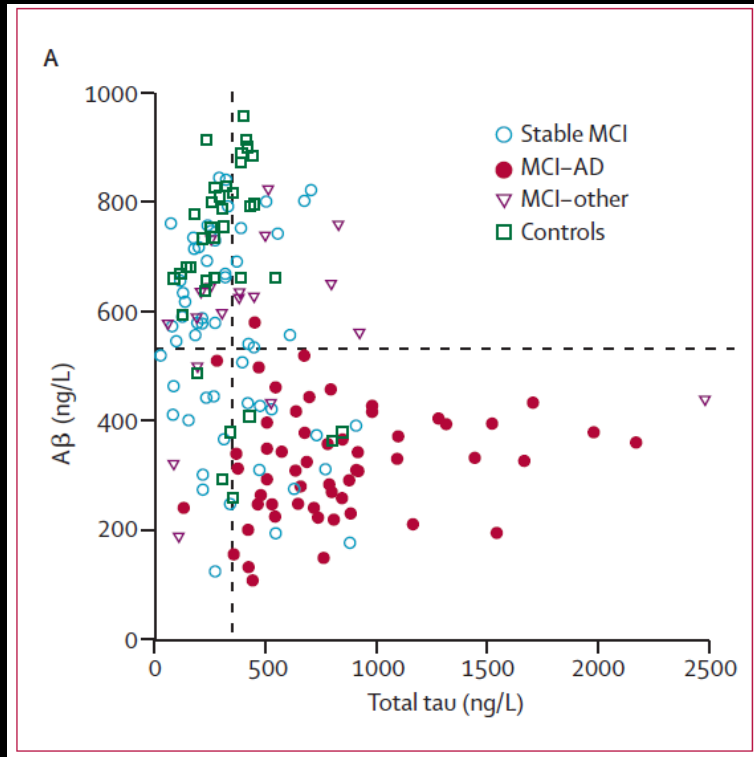
Amyloidopathie / tauopathie



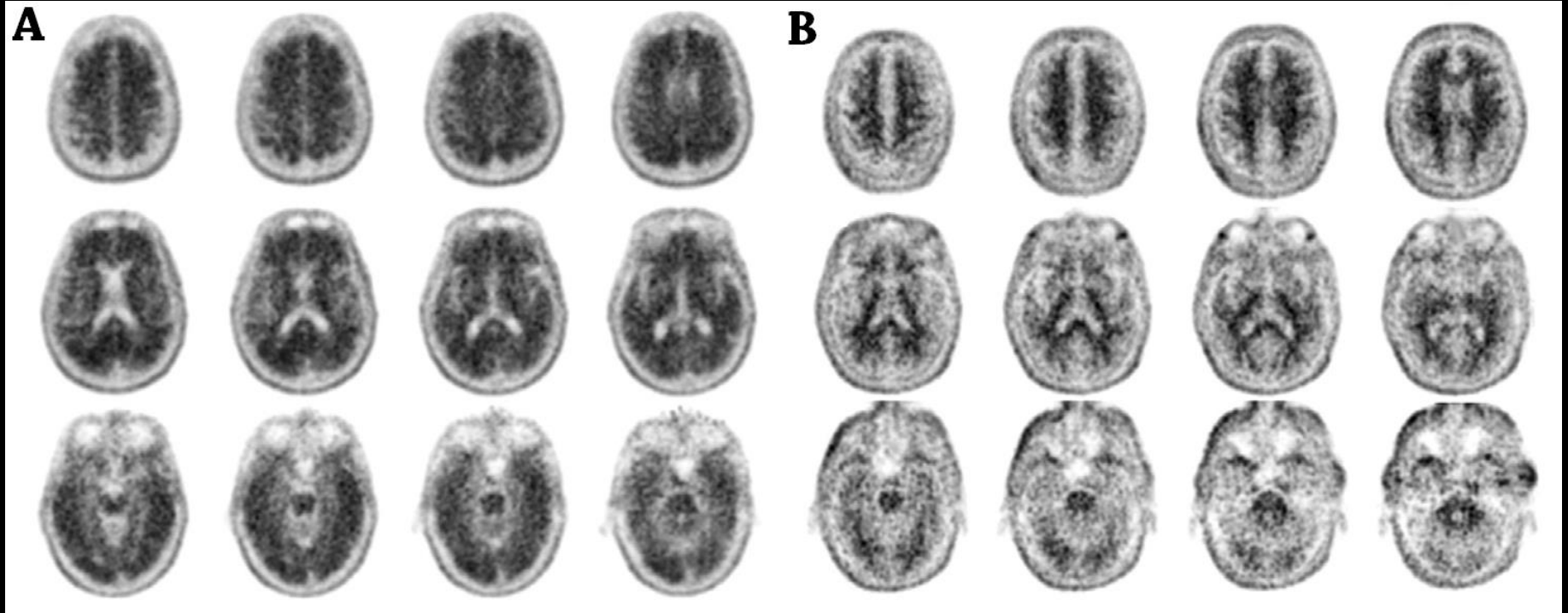
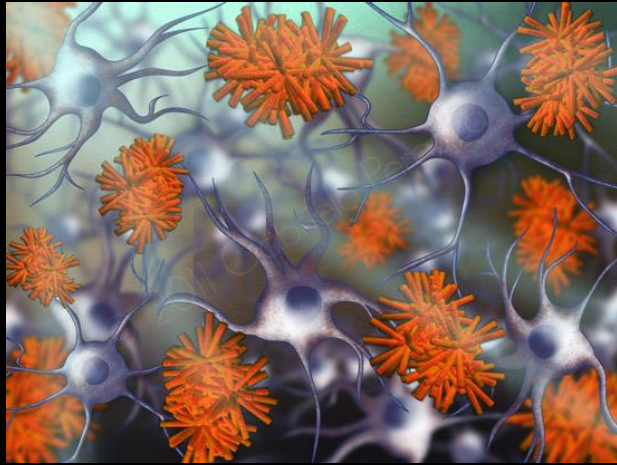
Amyloidopathie / tauopathie



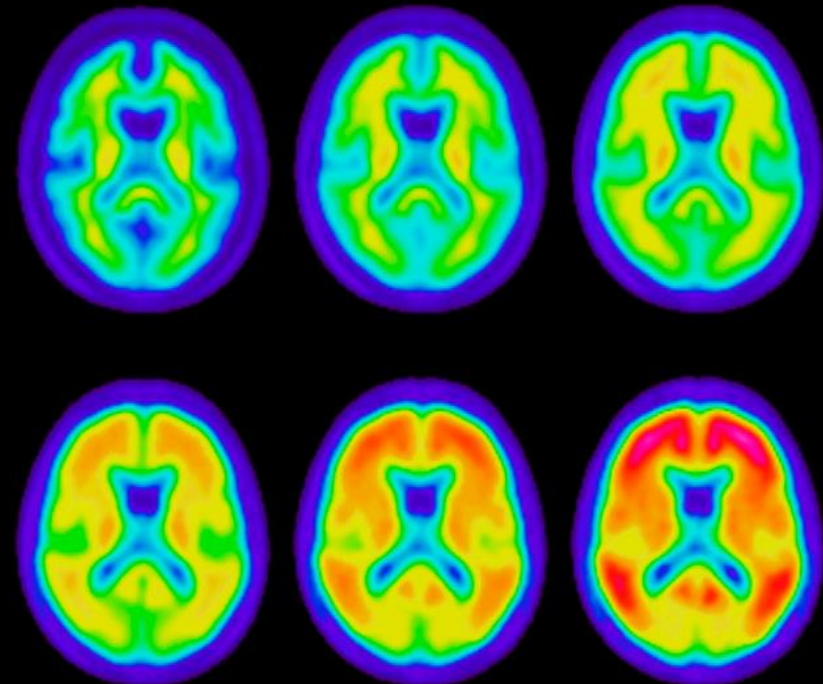
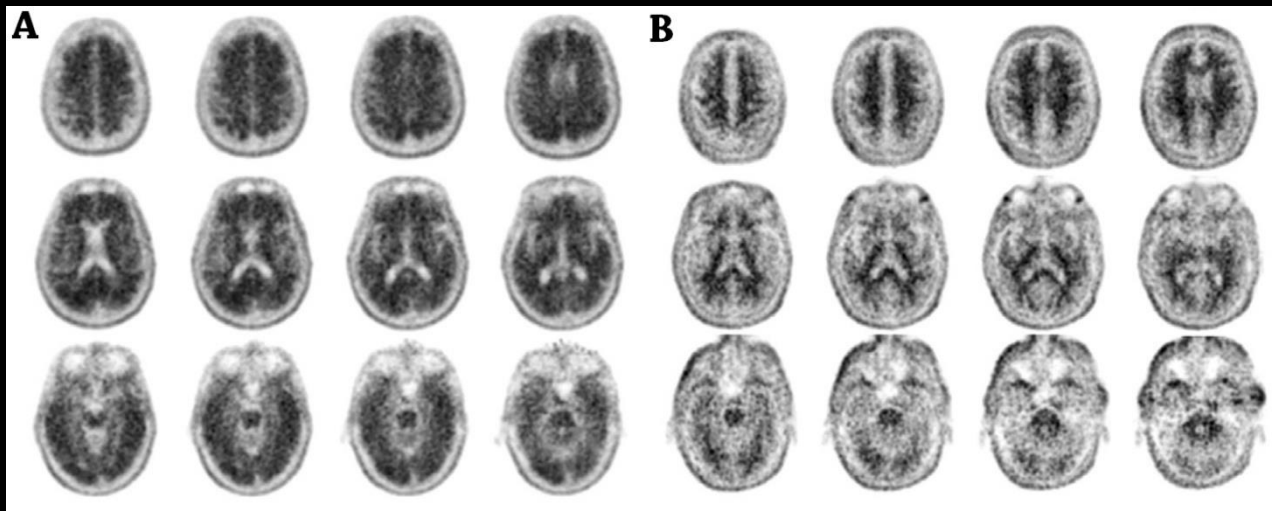
Amyloidopathie / tauopathie



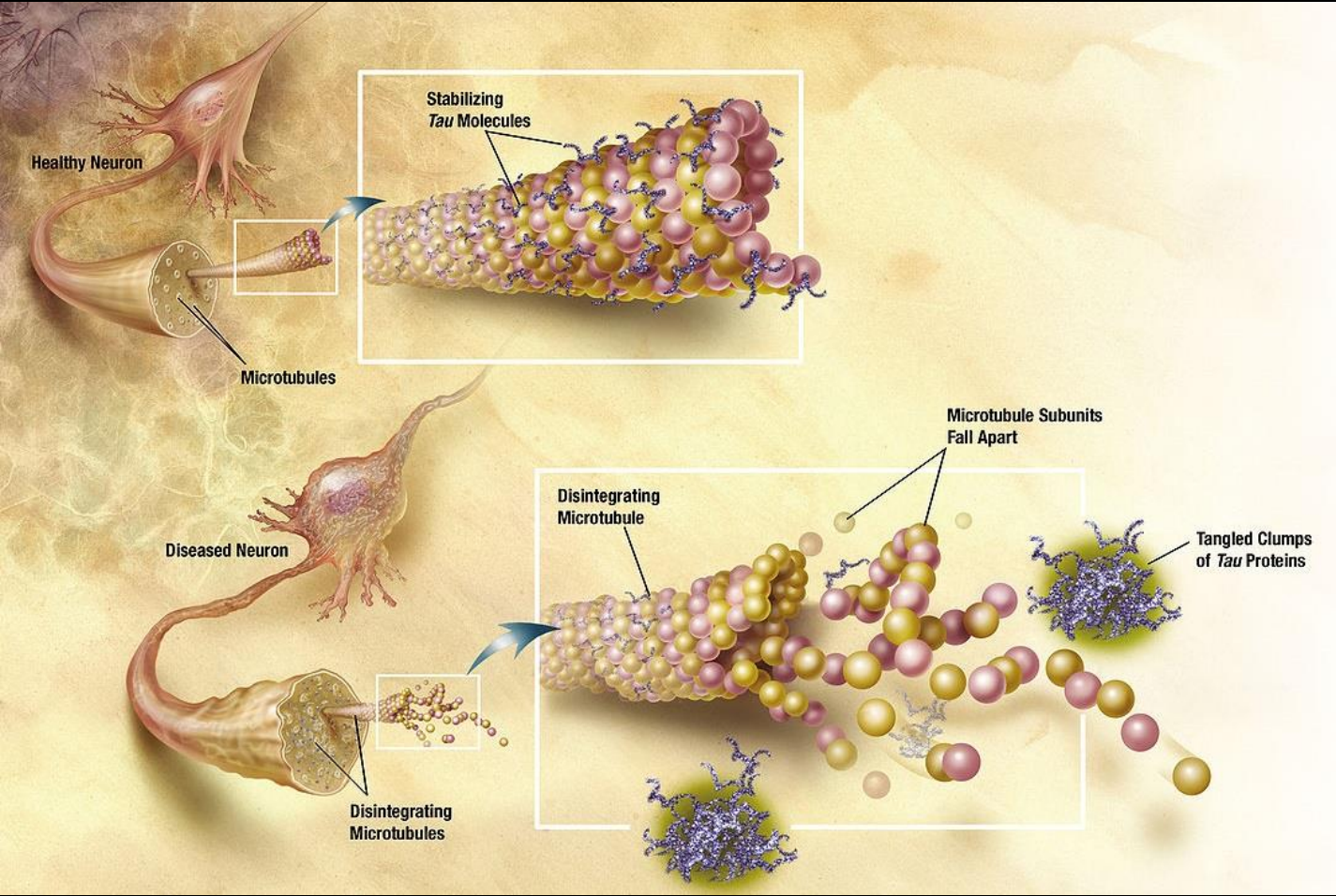
Amyloidopathie / tauopathie



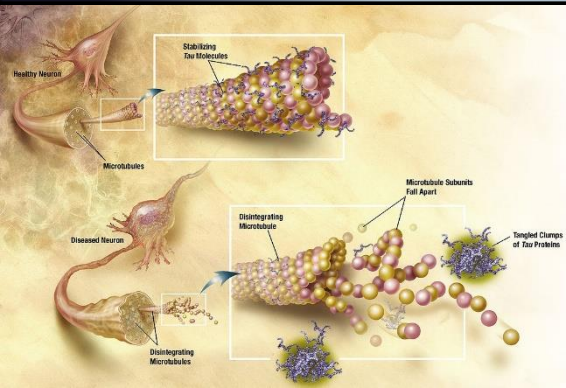
Amyloidopathie / tauopathie



Amyloidopathie / tauopathie



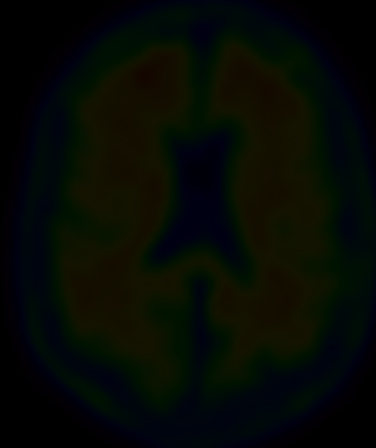
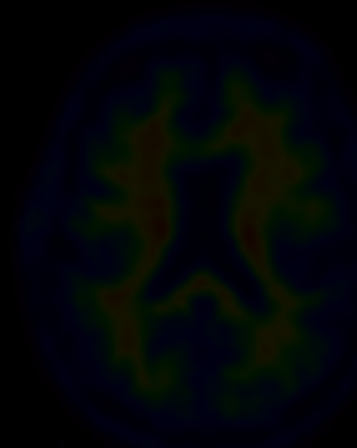
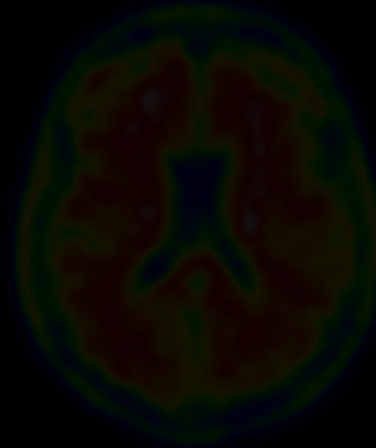
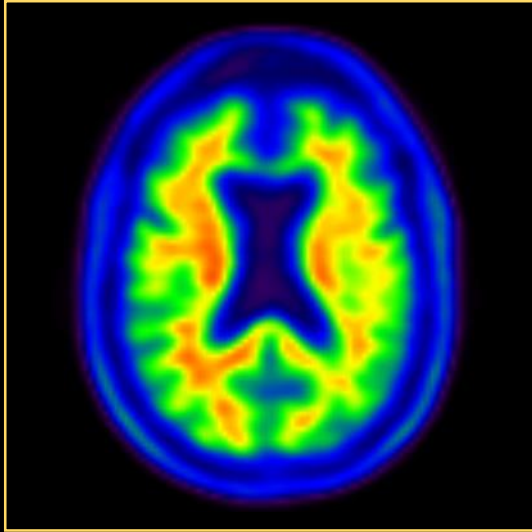
Amyloidopathie / tauopathie



Amyloïdopathie / tauopathie

Cas #1

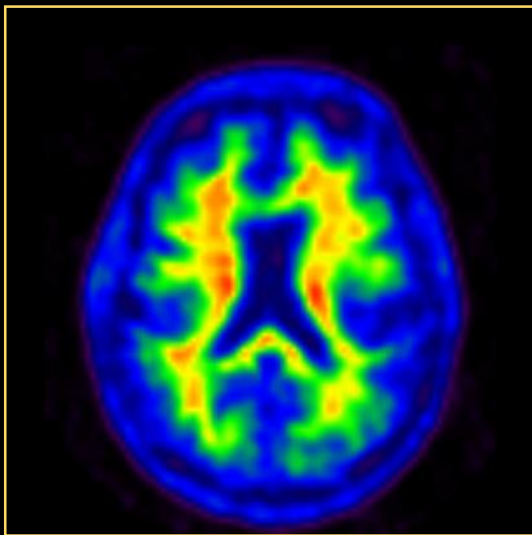
Femme, 72 ans, troubles du comportement



Amyloïdopathie / tauopathie

Cas #2

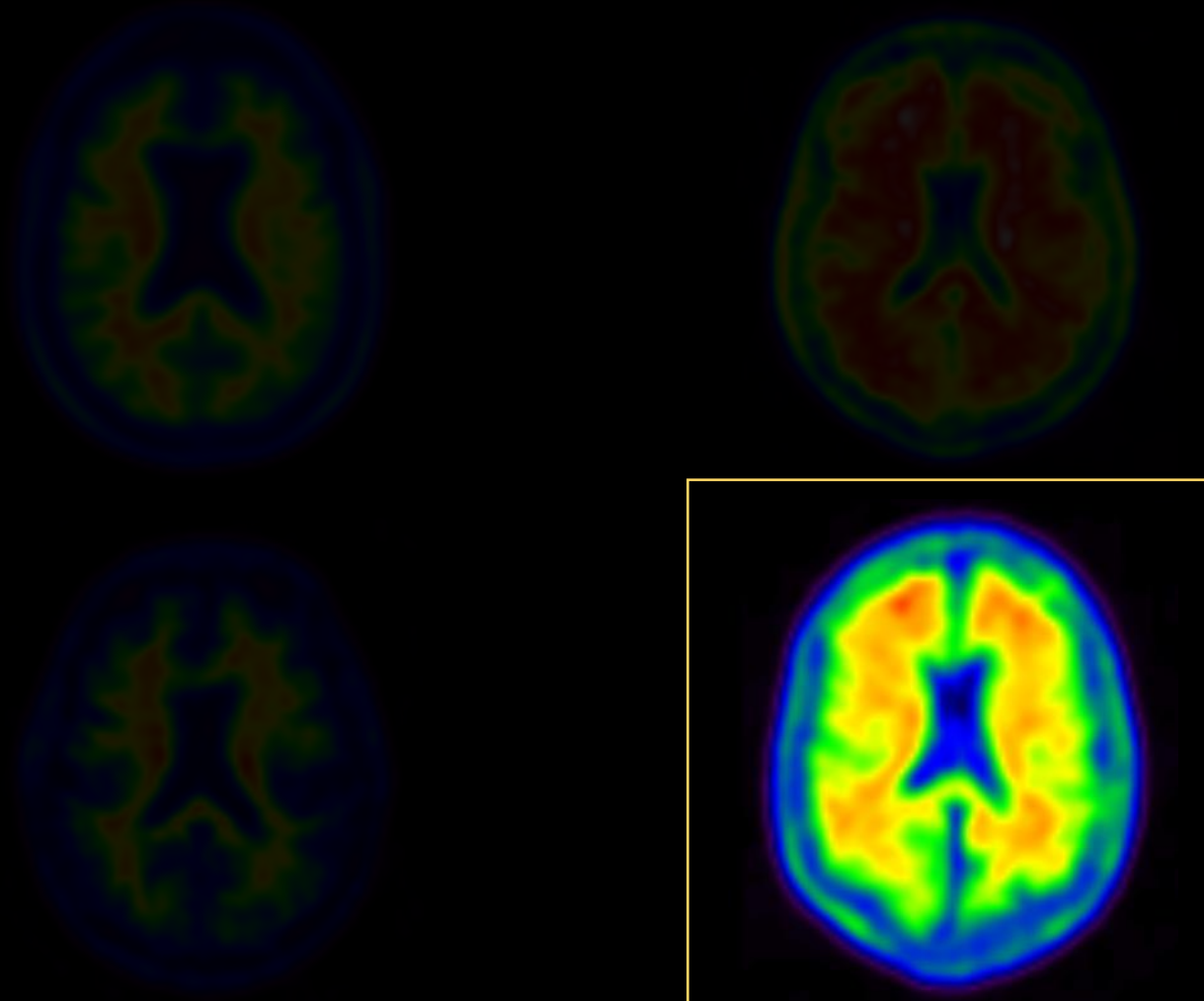
Homme, 65 ans, plainte cognitive & syndrome extra-pyramidal



Amyloïdopathie / tauopathie

Cas #4

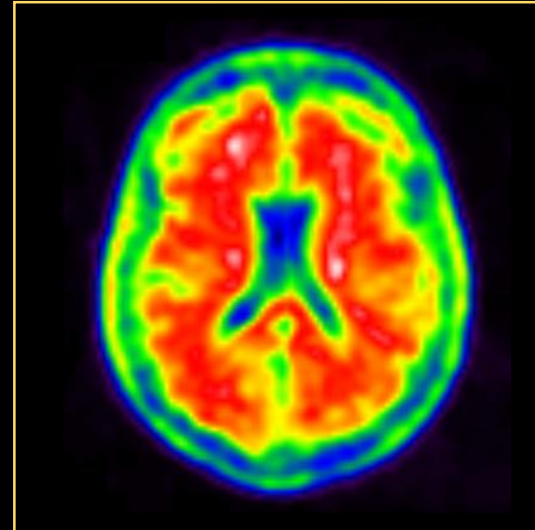
Femme, 81 ans, ralentissement psycho-moteur



Amyloïdopathie / tauopathie

Cas #3

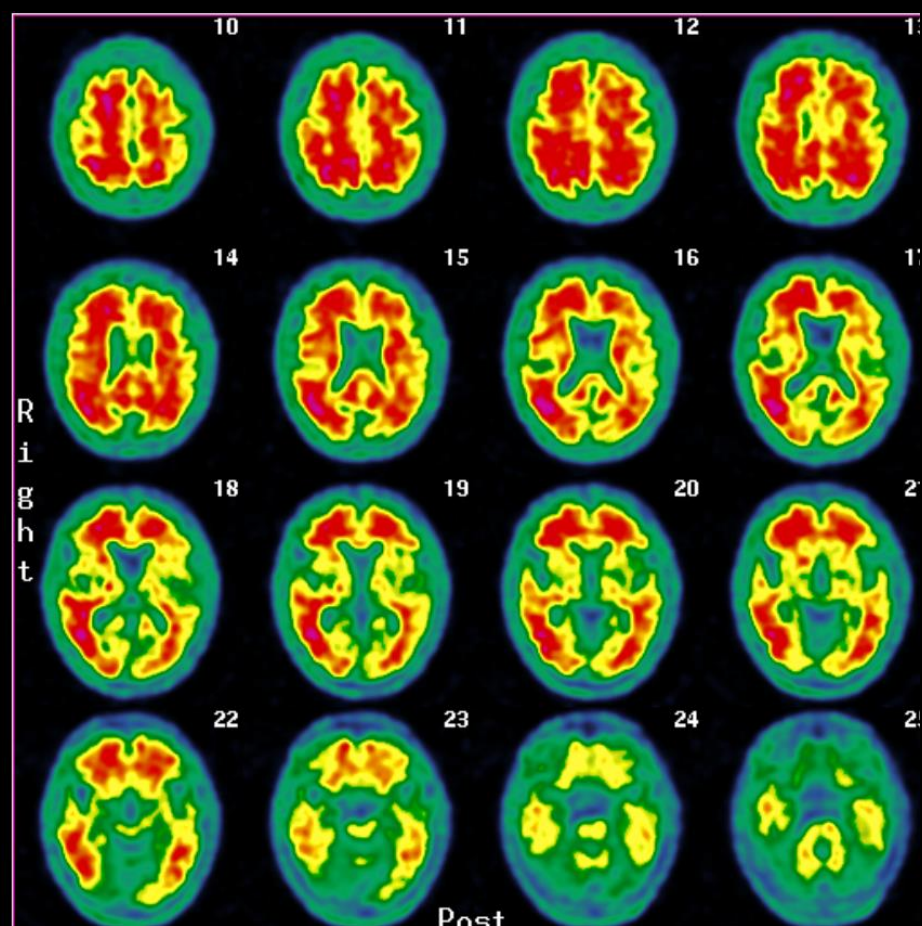
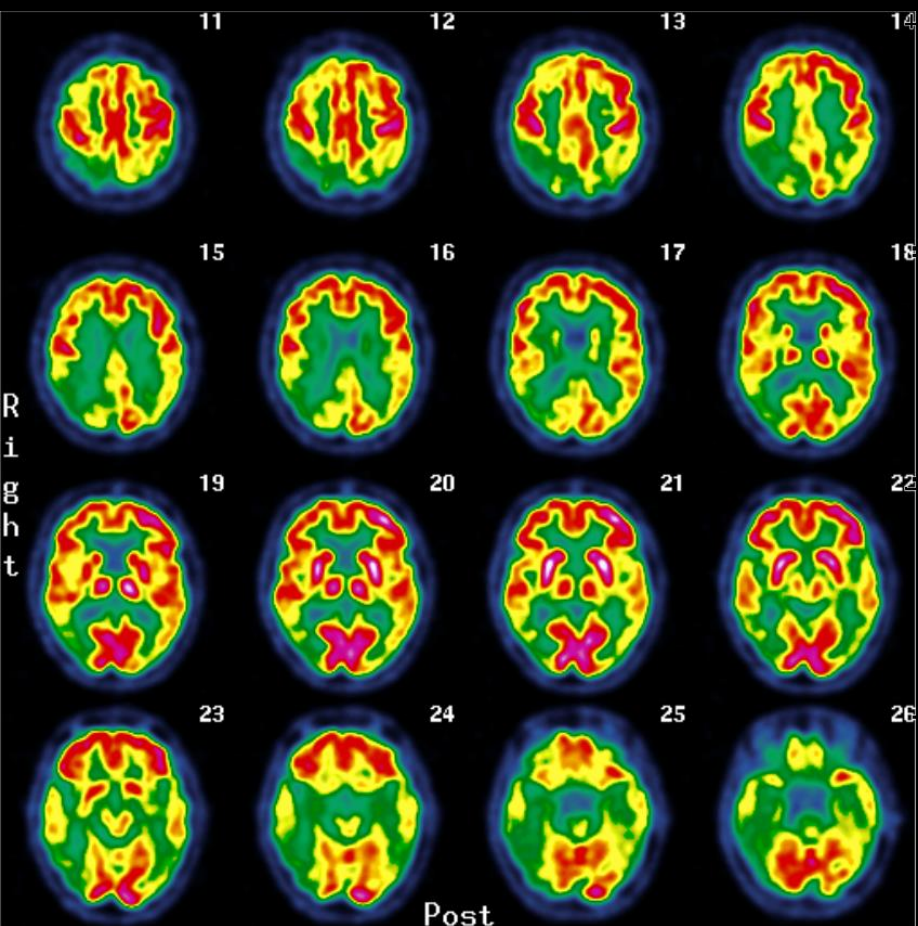
Homme, 55 ans, antécédents familiaux de MA



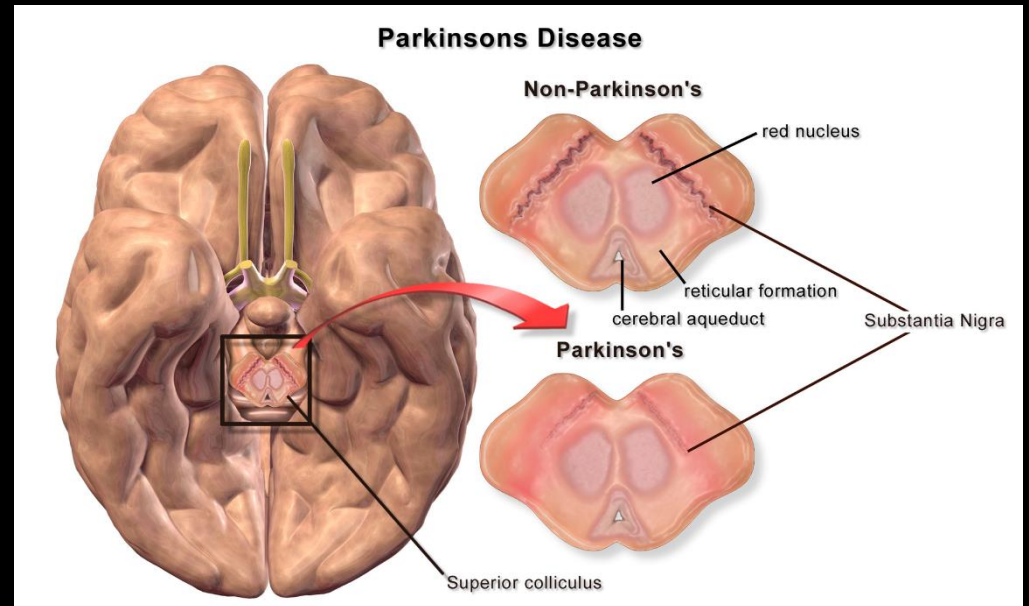
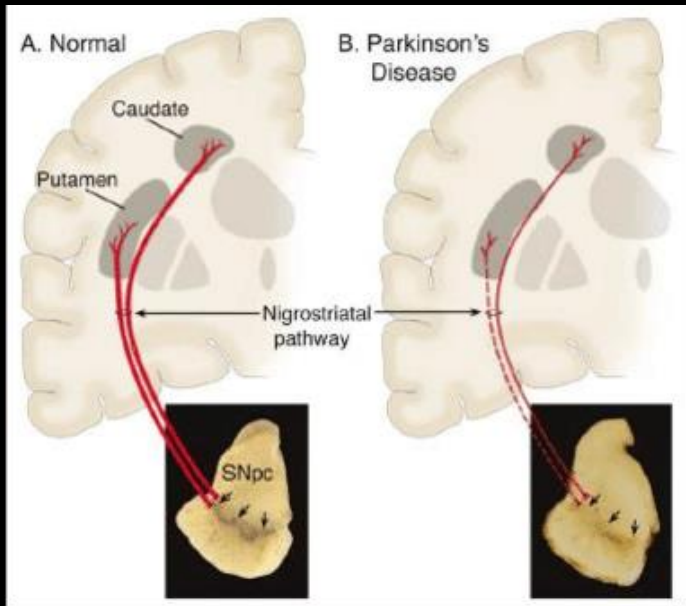
Amyloïdopathie / tauopathie

Cas #5

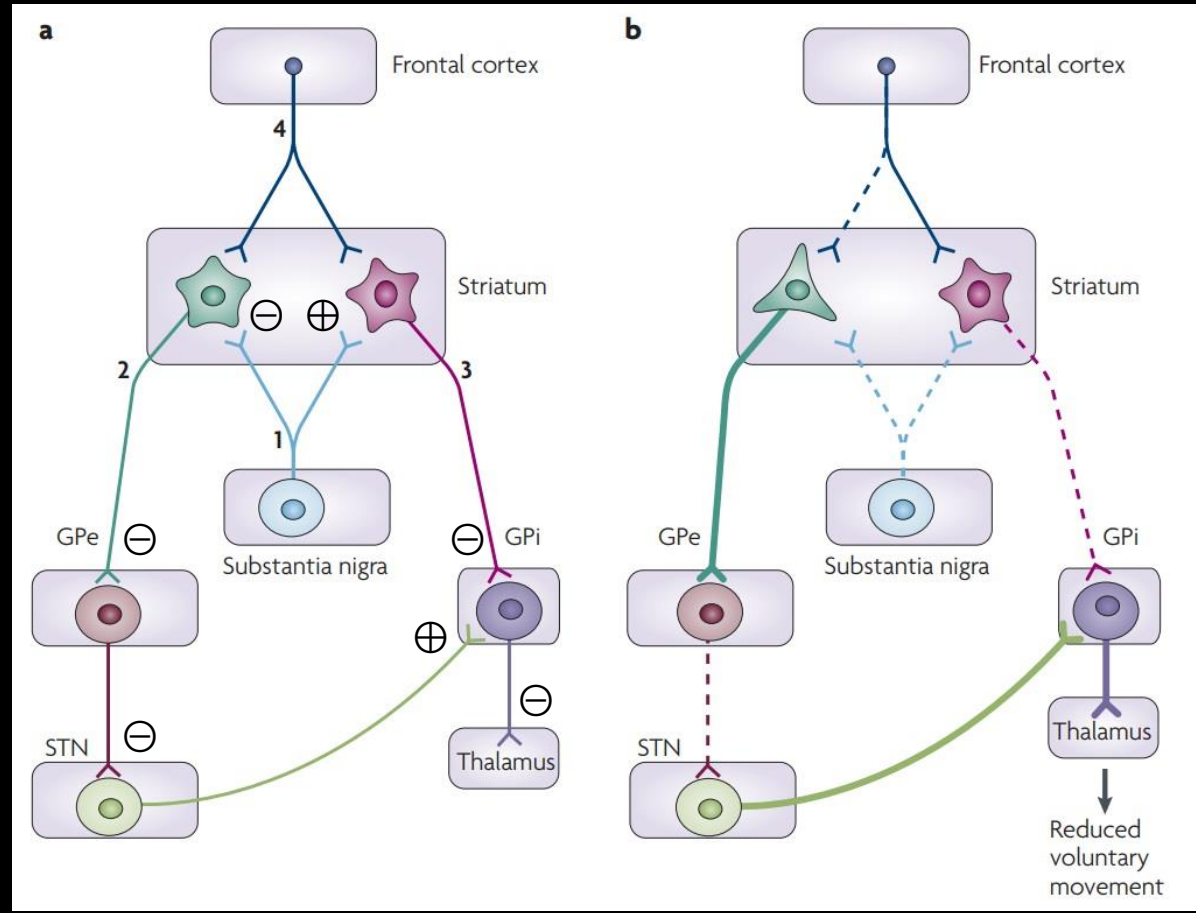
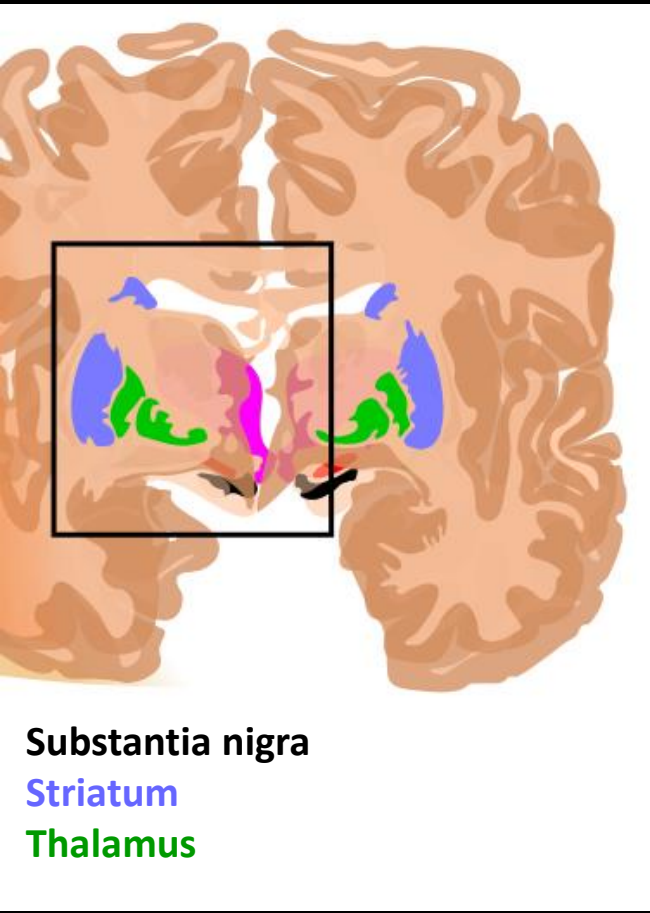
Homme, 55 ans, troubles mnésiques



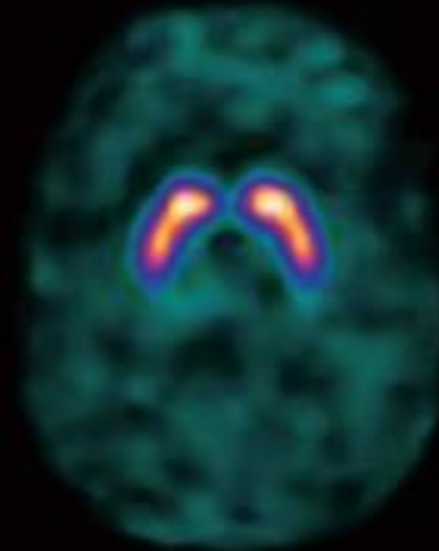
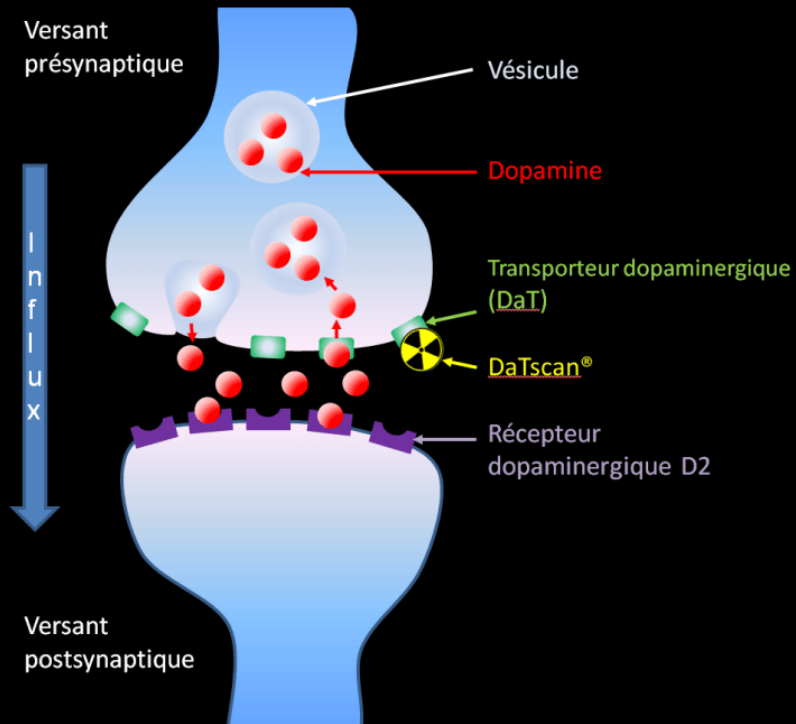
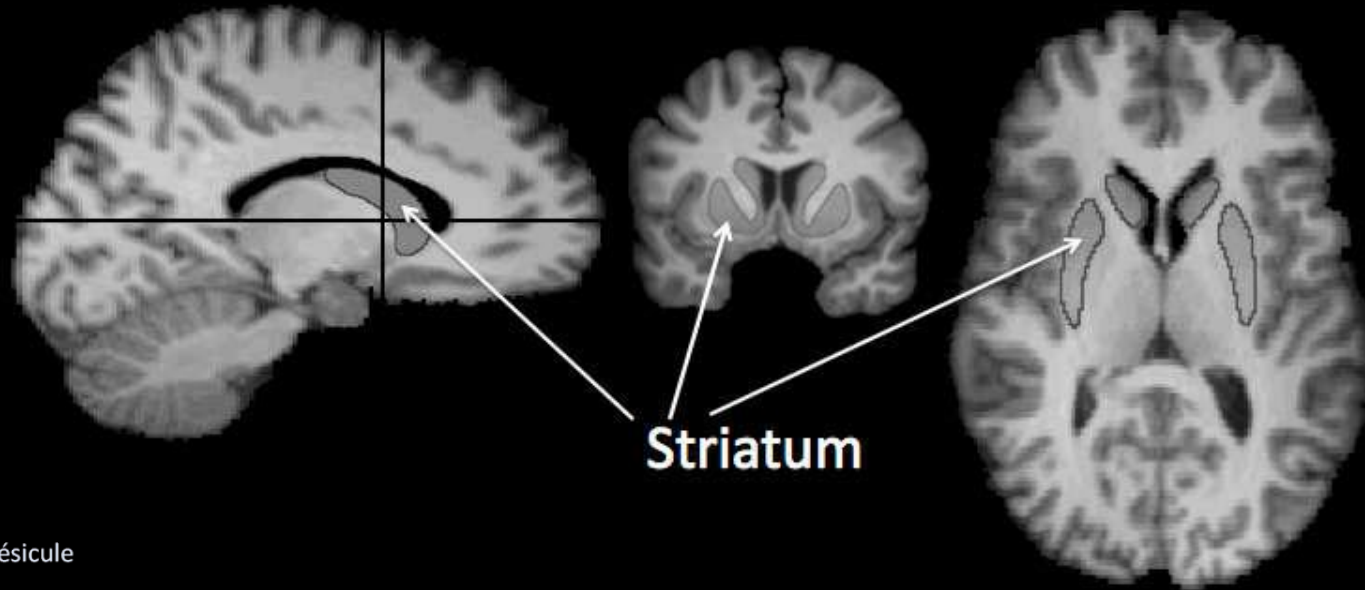
Innervation dopaminergique : ^{123}I -Datscan



Innervation dopaminergique : ^{123}I -Datscan



Innervation dopaminergique : ^{123}I -Datscan



Innervation dopaminergique : ^{123}I -Datscan

1.3. Indications thérapeutiques

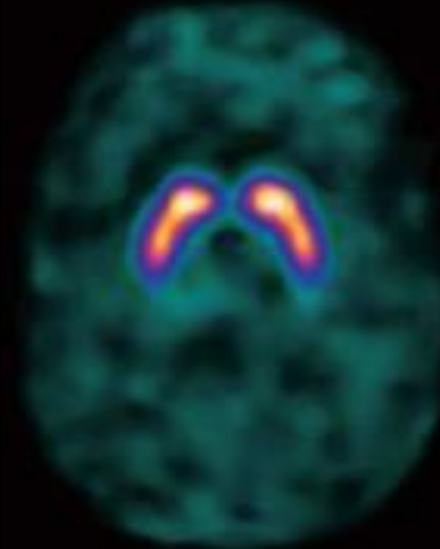
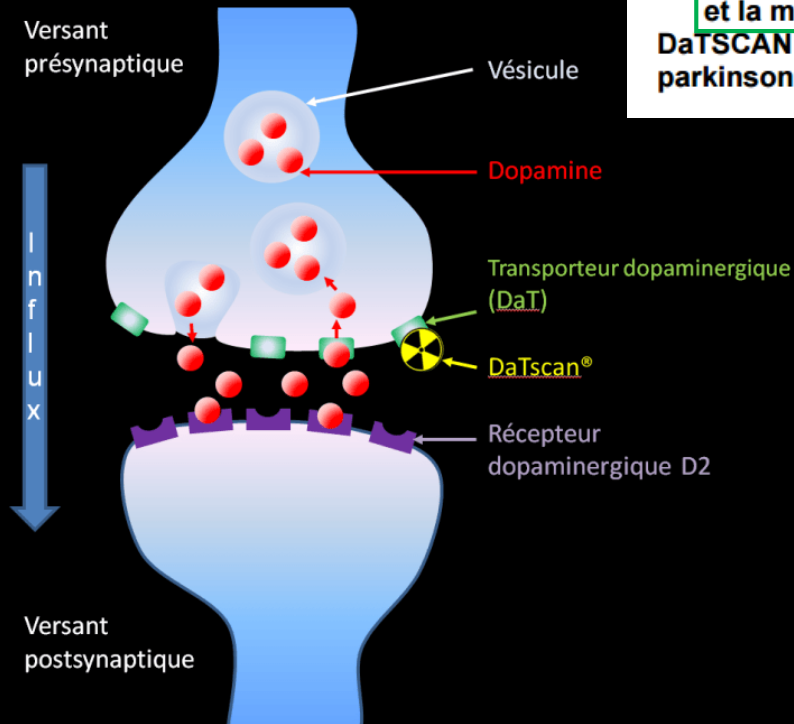
DaTSCAN est indiqué dans la détection d'une perte de terminaisons neuronales dopaminergiques fonctionnelles dans le striatum :

- Chez les patients présentant un **syndrome parkinsonien cliniquement douteux**, afin d'aider au **diagnostic différentiel entre tremblement essentiel et syndromes parkinsoniens** liés à la maladie idiopathique de Parkinson, à l'atrophie multisystématisée ou à la paralysie supranucléaire progressive.

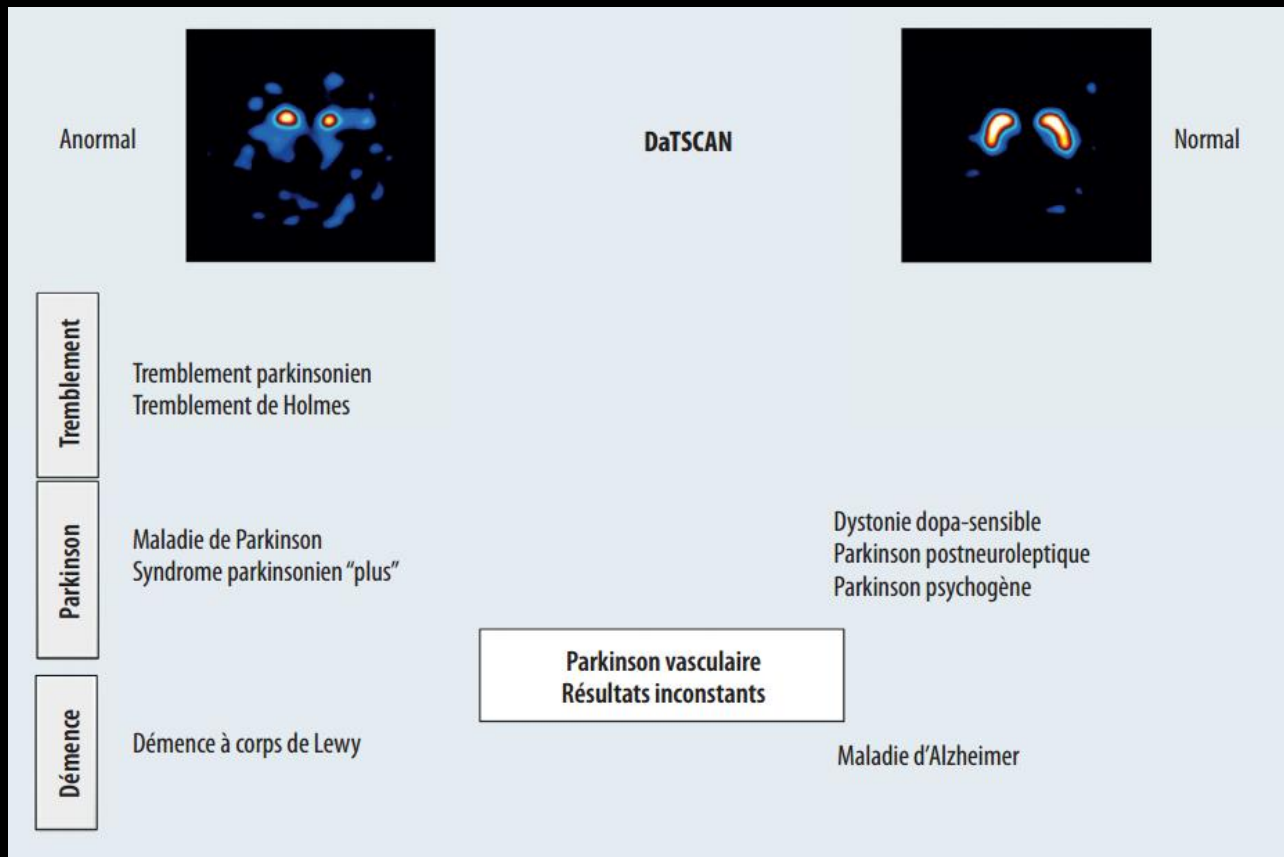
DaTSCAN ne permet pas la différentiation entre maladie de Parkinson, atrophie multisystématisée et paralysie supranucléaire progressive.

- **Pour aider au diagnostic différentiel entre une démence à corps de Lewy probable et la maladie d'Alzheimer.**

DaTSCAN ne permet pas la différentiation entre démence à corps de Lewy et démence parkinsonienne.



Innervation dopaminergique : ^{123}I -Datscan



Innervation dopaminergique : ¹²³I-Datscan

All Patients with 36-Month Consensus Clinical Diagnosis of Probable or Possible PD (Study 1),¹² n = 71

	Normal [¹²³ I]FP-CIT SPECT at Baseline		Abnormal [¹²³ I]FP-CIT SPECT at Baseline	
	n	Mean UPDRS	n	Mean UPDRS
Baseline (T = 0)	15	11.0	56	11.0
36 months (T = 36)	15	14.4	55	21.1
UPDRS Change	15	3.4	55	10.2*

*P = 0.003 vs. all patients with normal DaTscan at baseline.

Hauser et al. J Neuroimaging 2012

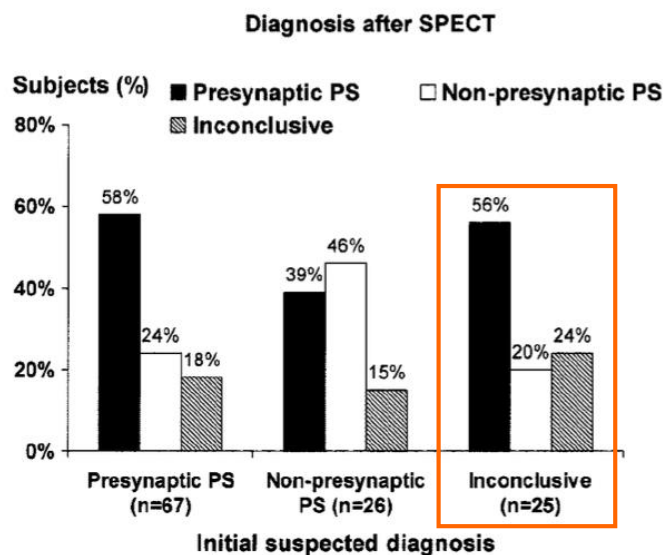


FIG. 3. Changes in the diagnosis after SPECT results.

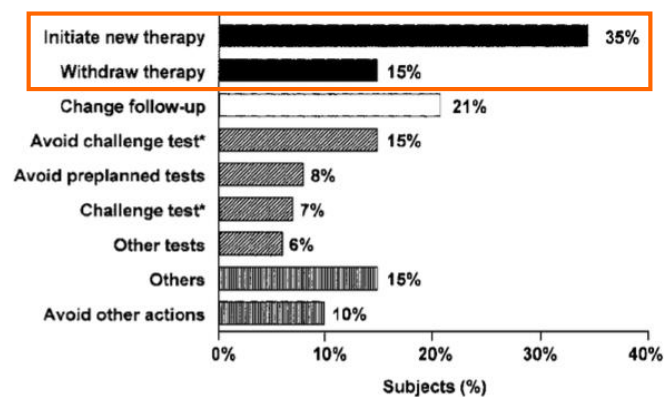


FIG. 5. Changes to planned management after ¹²³I-Ioflupane SPECT imaging. One patient can have more than one item. Challenge tests: L-dopa or apomorphine

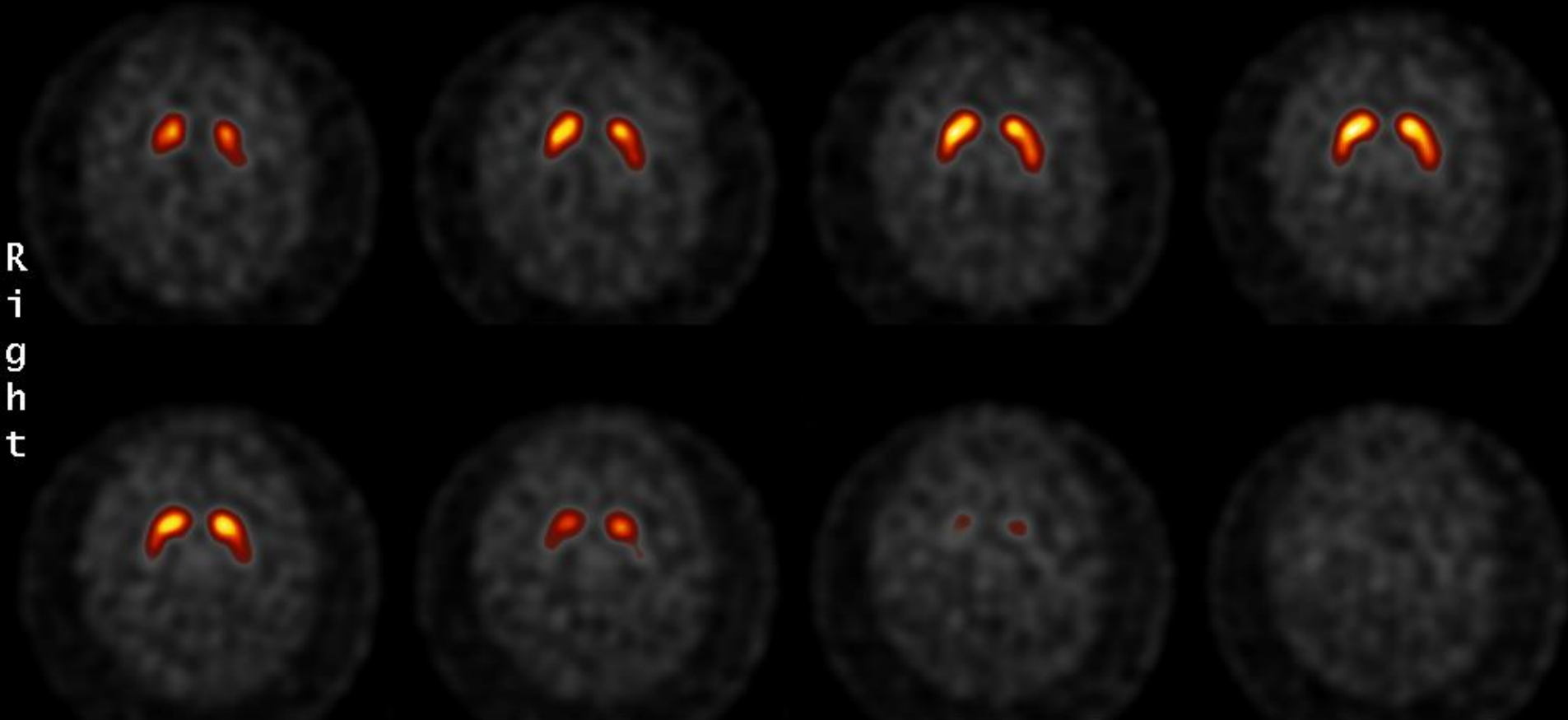
Catafau et al. Mov Disord 2004

Innervation dopaminergique : ^{123}I -Datscan

Cas #1

Femme, 74 ans

Tremblement membre supérieur droit

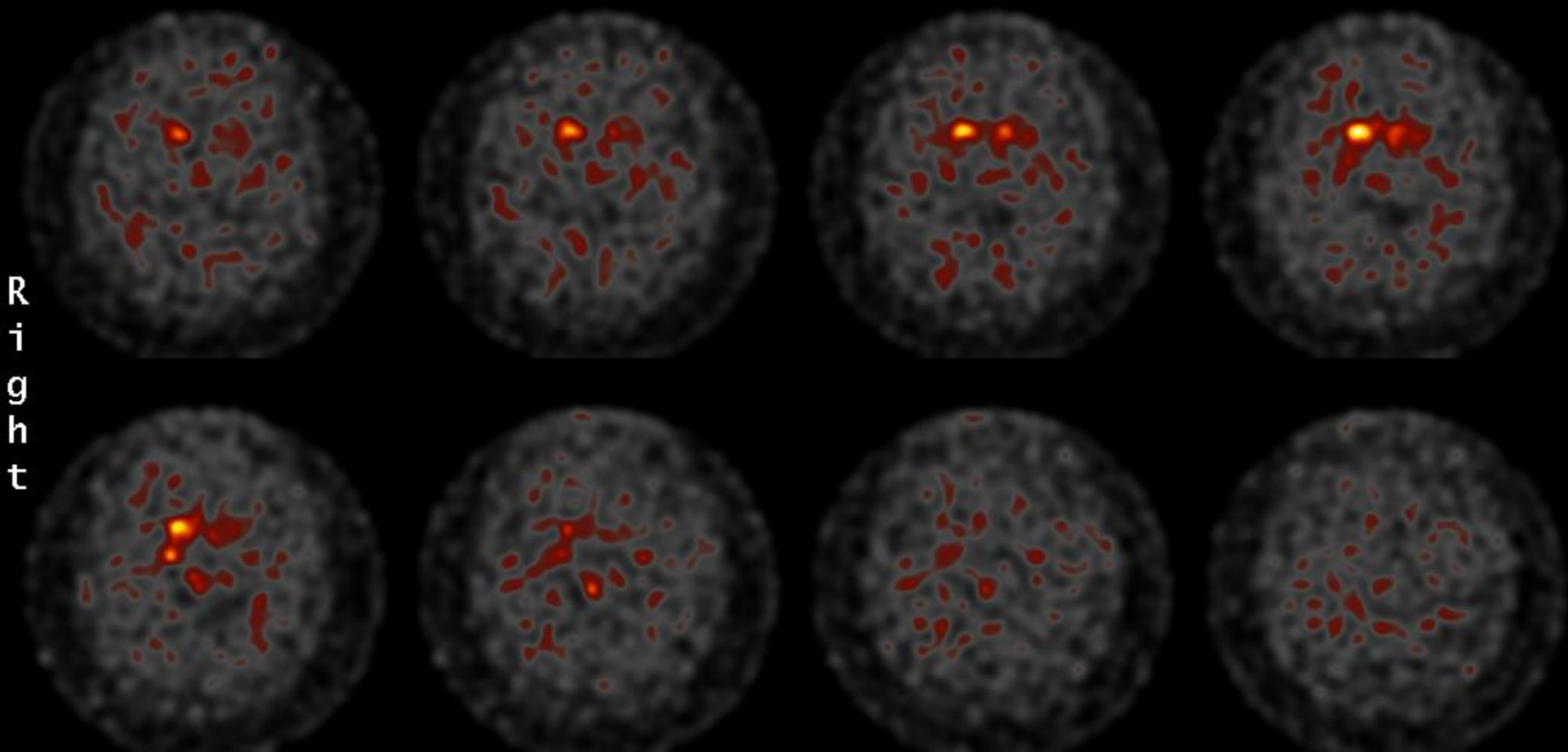


Innervation dopaminergique : ^{123}I -Datscan

Cas #2

Homme, 54 ans

Syndrome akinéto-rigide prédominant à droite, tremblement de repos



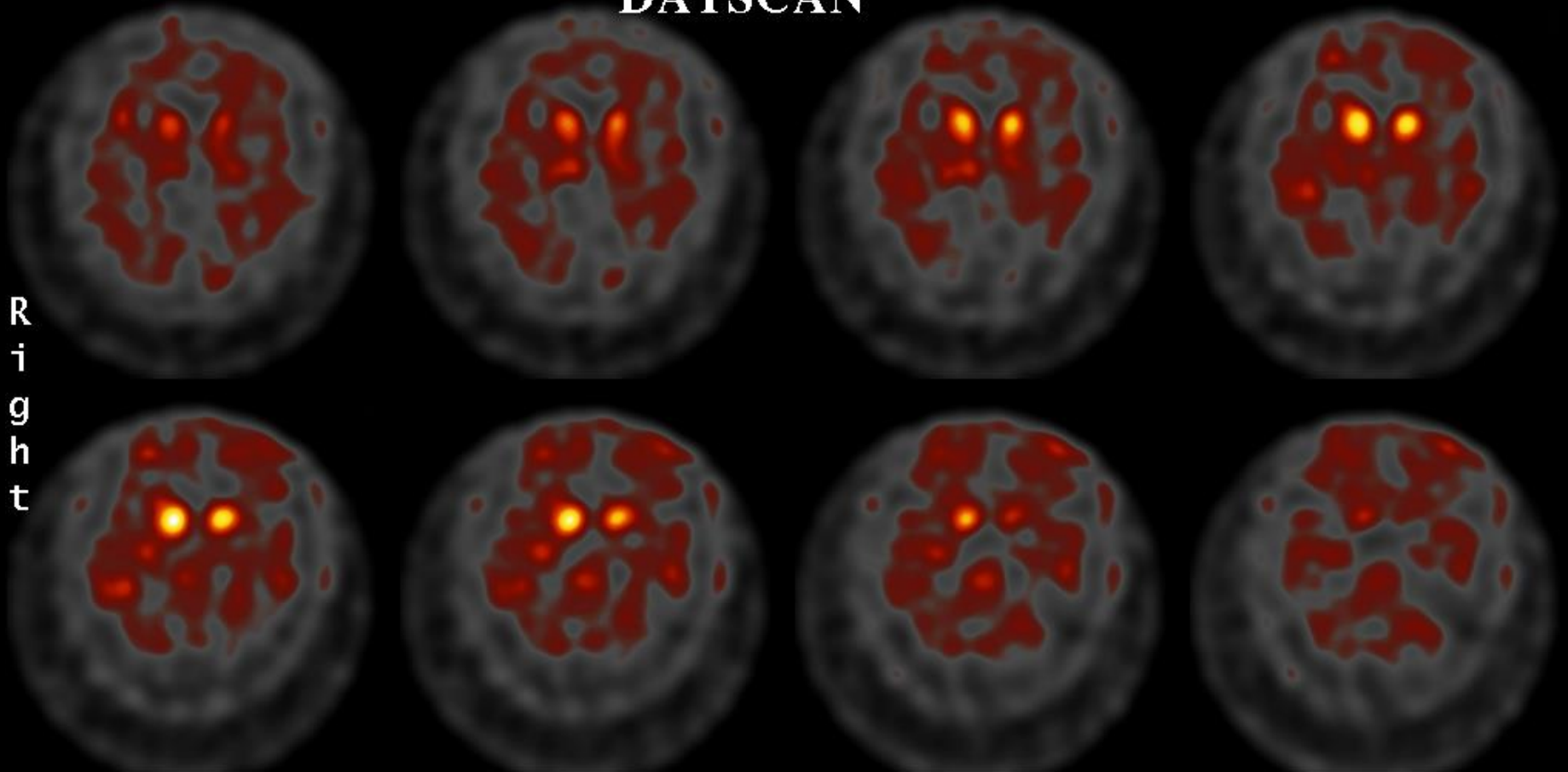
Innervation dopaminergique : ^{123}I -Datscan

Cas #3

Homme, 69 ans

Syndrome parkinsonien, troubles cognitifs, hallucinations

DATSCAN



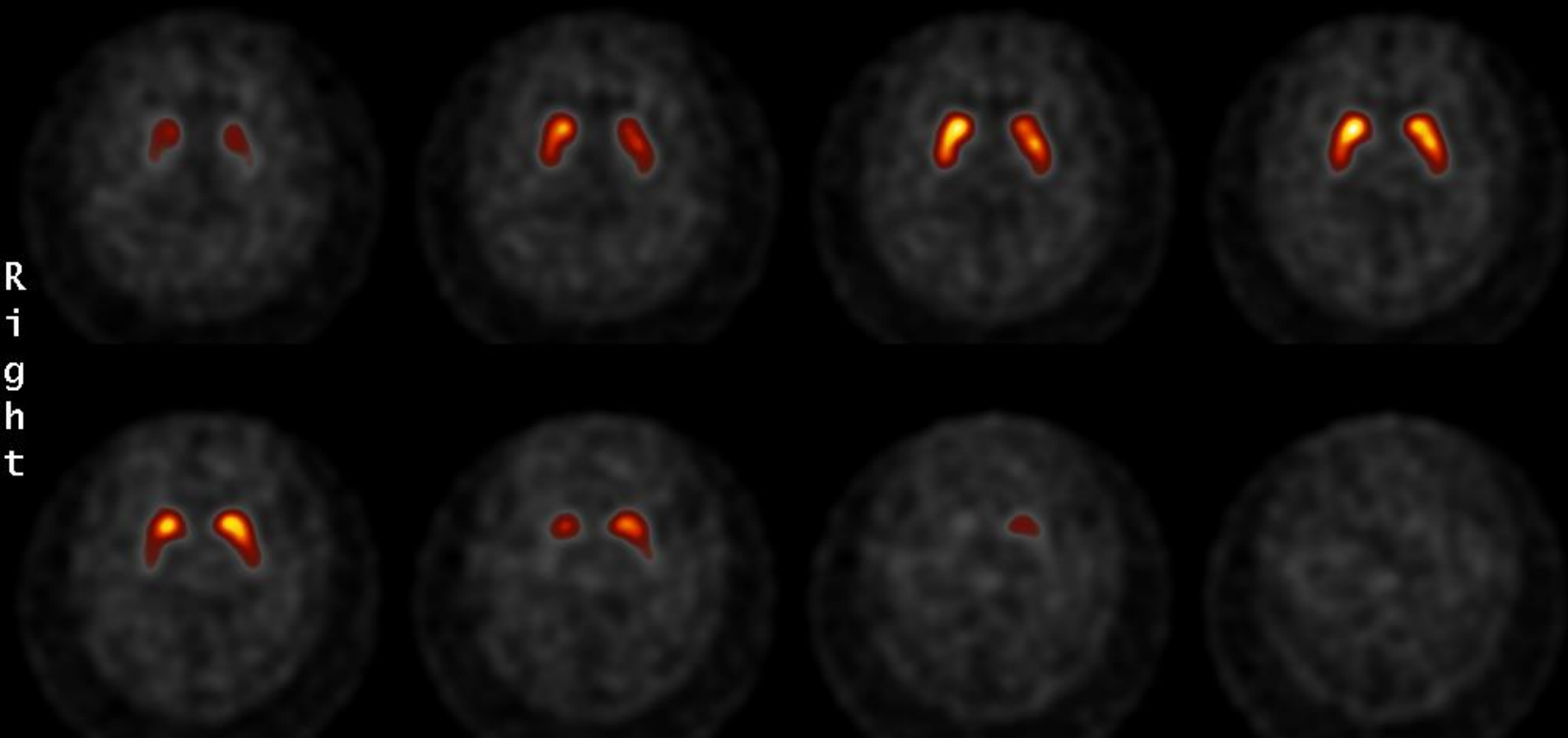
Innervation dopaminergique : ^{123}I -Datscan

Cas #4

Homme, 65 ans

Syndrome parkinsonien

Schizophrénie sous neuroleptique

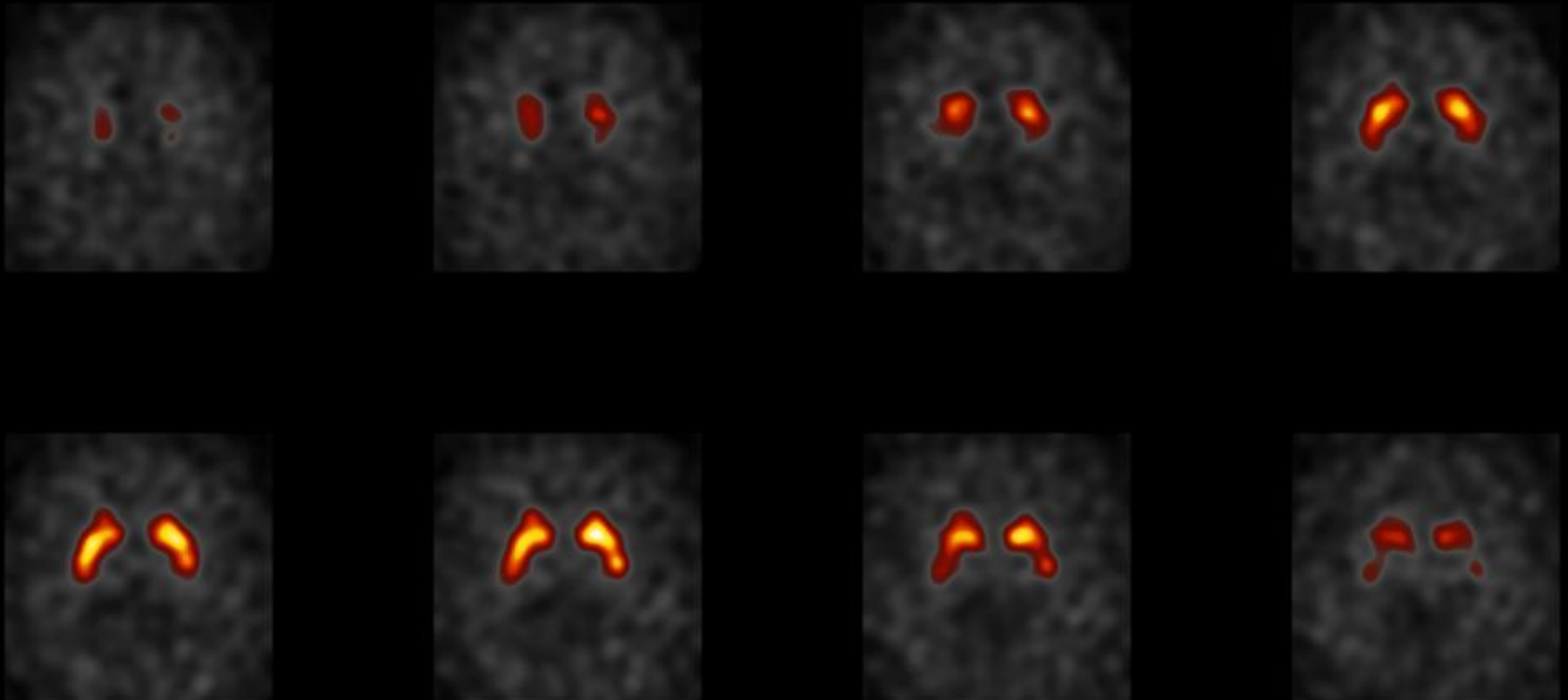


Innervation dopaminergique : ^{123}I -Datscan

Cas #5

Homme, 60 ans

Syndrome cérébelleux



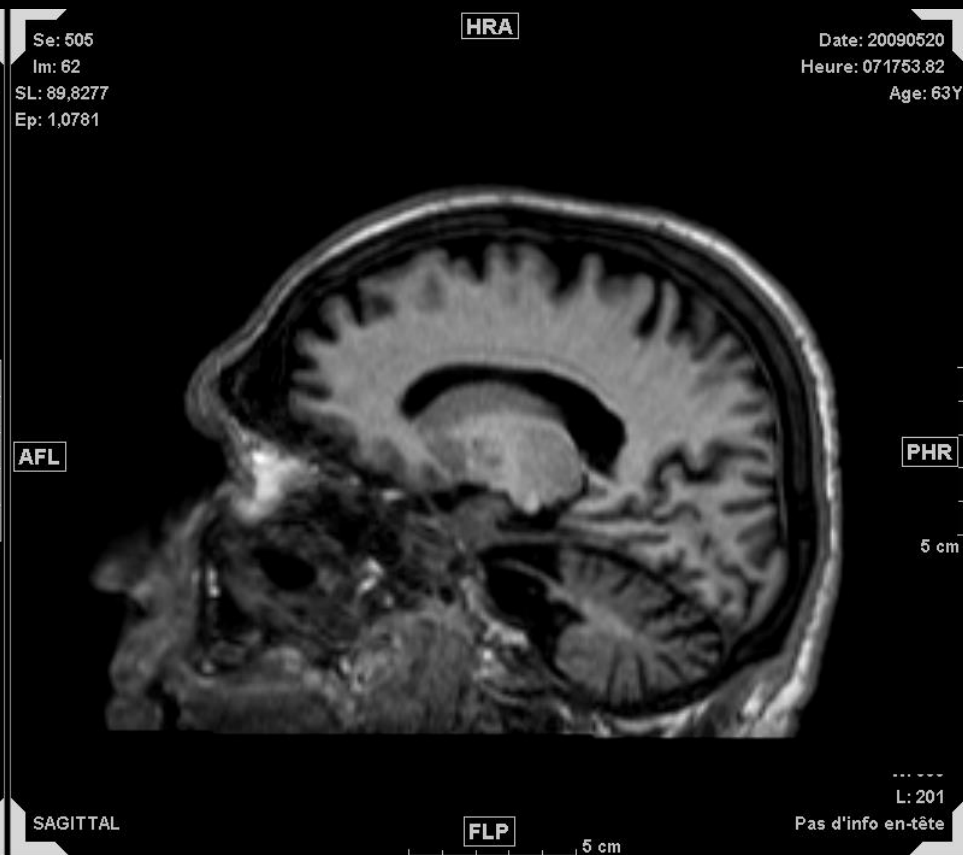
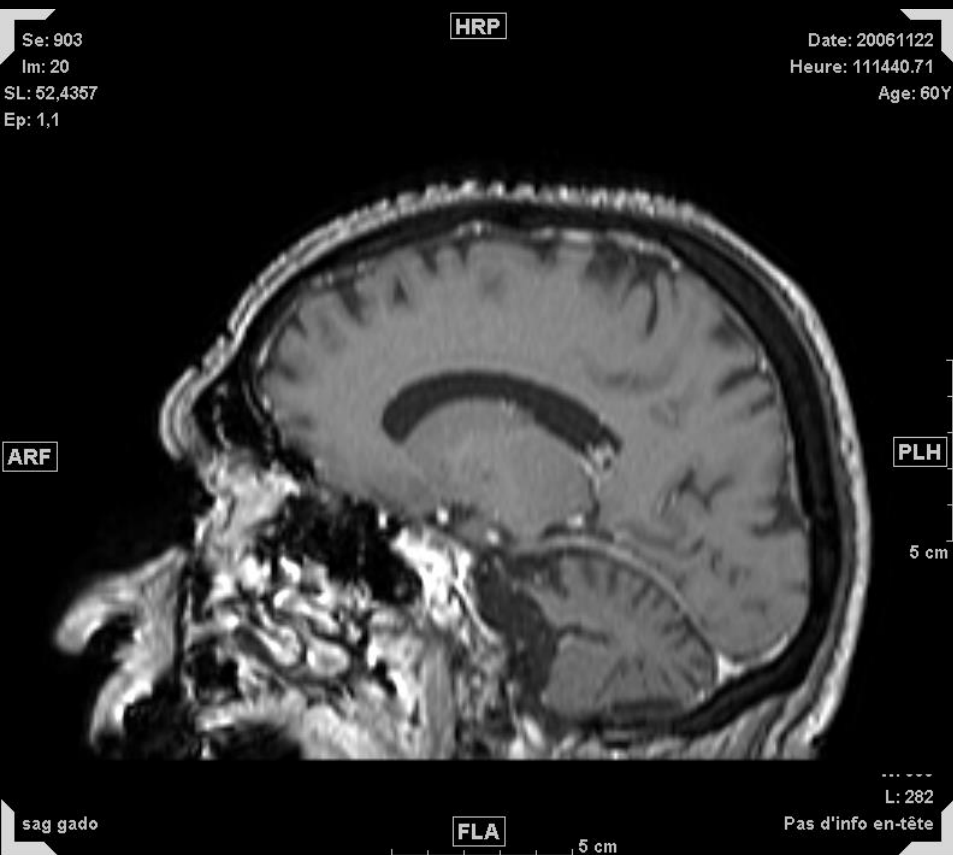
R
i
g
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t

Innervation dopaminergique : ^{123}I -Datscan

Cas #5

Homme, 60 ans

Syndrome cérébelleux



Innervation dopaminergique : ^{123}I -Datscan

Cas #6

Femme, 61 ans

Troubles de la marche, troubles du sommeil paradoxal, troubles du transit

